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ELECTRIC MOTOR FOR PROPELLING SHIPS.

Some time ago we described an interesting method of propelling ships, proposed by a Russian. Several vessels, constructed according to his ideas, were tried. The results of these tests have been reported rather briefly, but it may be said that they, at least, were promising. The idea of this system was to utilize the internal-combustion engine, with its high thermal efficiency. But to adopt this engine to propulsion, a transmission gear was necessary. That proposed was a generator coupled to the engine, thus supplying power to one or more motors driving an equal number of propellers. The electrical transmission gear was not only efficient, but made it possible for the engine to run at its most efficient speed, while the speed of the propellers was that best suited to them. An incidental advantage of the system was the bringing of the control of the propelling motors directly under the hand of the pilot.

Now, a somewhat similar plan is suggested for steamships, by the *Engineering Times,* to overcome the difficulties which have been met in applying the steam turbine to this work. This prime mover is at its best at high speeds, while the propellers, for efficient working, should be driven at much lower speeds. Therefore, in order to drive directly, not only must the turbine itself be run at a speed lower than is best, and hence be large and expensive, but the propellers must also compromise and run at higher speeds than is desirable. These disadvantages are removed by interposing an electrical link. By using a high-speed turbine directly connected to a generator, the former may be designed for that speed which best suits it. Since there is no fixed relation between the speed of the generators and the speed of the motors, the latter may be built so as to suit the propellers. Hence, each mechanism works at its most efficient speed. Moreover, the system not only gives the pilot complete control of his propelling machinery, so that he can regulate the speed at will, but it makes reversing possible. With the ordinary steam turbine equipment, a reversing turbine must be introduced. With the electric drive this turbine is eliminated. Further, on naval vessels, where most of the cruising is done at low speeds, but which must be capable of sustained high speeds when occasion demands, it has become customary to introduce a second set of turbines simply for cruising purposes. With the electrical system this unit is also eliminated. By these savings, and taking into consideration the smaller size of the high-speed turbine, as compared with the low-speed direct-current turbine, it is estimated that the introduction of the electrical link will not increase the weight

of the equipment, nor its cost, and will, besides, give the advantages which have been enumerated.

At the present time we are not aware of any attempt to apply such a system to boat propulsion. A somewhat similar system has, however, been tried for self-propelling vehicles, although the prime mover in this case has generally been a gasolene engine. If, however, this arrangement proves satisfactory for railway purposes, there seems to be no reason why the electrical steamer should not also be successful.

THE END OF THE N-RAYS.

Back in 1904, at the time when the discovery of radium and its peculiar properties was causing such a stir in scientific circles, a surprising announcement of the discovery of an entirely new type of radiation was made from the University of Nancy, in France. The discoverer of the new phenomenon was M. R. P. Blondlot, and its presence was shown by the effect exerted upon sources of light. The rays were said to emanate from various substances, notably metals in a state of strain, such as a tempered file. By bringing such an article before a source of light, it was said that a distinctly noticeable change in the intensity of the luminosity was observable.

This supposed property seemed so extraordinary that the experiments were at once repeated throughout the scientific world, but unfortunately for those who had described the experiments, similar results could not be obtained outside of France. To explain this, it was said that while the effect was observable, the experiment was somewhat delicate, and it required a well-trained eye; but in spite of these assertions the scientific world, outside of France, remained unconvinced of the existence of the so-called N-rays.

During the summer of 1904, Professor R. W. Wood, of Johns Hopkins University, while traveling in Europe, visited the University of Nancy and saw the experiments repeated, and he, in a statement published in the ELECTRICAL REVIEW, October 15, 1904, said that he could not observe the change in luminous intensity which was said to take place. When he himself handled the objects supposed to be the source of the radiation, the observer, who had previously noted the effect without fail, did not seem to be able to tell when Professor Wood held a file, or a pine stick, in his hand.

In order to determine if the effect were psychological, attempts were made to photograph the source of light when subjected to the new effect and records were thus obtained. Although it was said by those who believed in the existence of the new radiation that the photographs proved it conclusively, others asserted that photographs of such subjects are too likely to be affected by other influences, and could not be taken as proof of the existence of the new phenomenon.

After Professor Wood's statement, but little was heard of the new radiation, although certain physicists, who had previously believed in its existence, still adhered to their beliefs. More recently the suggestion made by Professor Wood, that conclusive tests should be made to determine the existence or non-existence of the phenomenon, was followed, and the experiments were described by M. Henri Peiron in a recent number of the *Annee Psychologique*. The tests in these experiments were made by enclosing materials, supposed to be sources of N-rays, and others supposed to be free from them, in similar wooden boxes. They were then sealed up and used to see whether any difference could be observed when any of these boxes was brought near to a source of light. As was expected, by those who suggested the test, of the several observers who had before been persuaded of the existence of N-rays, none of them could tell when the box held up contained steel or lead.

To most physicists these tests are fairly conclusive, and they bring to an end an interesting chapter in recent physical science. Of the sincerity and ability of those who believed that they could see the influence of the supposed radiation, no doubt whatever was ever raised. Others who could not accept their opinions attributed their results to some psychological influence. When once persuaded that the rays existed, the expectation of seeing the effect led the observer to believe that he did see it.

This little bit of history is a striking illustration of the need for scientific investigators to hold unformed opinions of what may result from any new experiment. It is particularly necessary when a new experiment is carried out to test a new theory. Even the best of us are not infrequently deceived, thinking we see that which we wish to see. Therefore, no one should accept the results of a few experiments in any such case. He should make a great number of experiments and vary them as much as possible. The fact that the effect being tried was suggested by the investigator himself should make him doubly careful in his observations.

ELECTRICAL MINE PUMPING.

An interesting illustration of the adaptability of the electric motor for pumping purposes has recently been made in England. A brief description of the system will be found on another page of this issue. In this particular instance the important Lindal Moor mines, which contain valuable deposits of iron ore, had been stopped because of an inrush of water, several years ago, which the old pumping system could not handle. The original pumping plant was operated by steam, and designed to handle about 3,000 gallons of water a minute, but when the inflow suddenly increased to 7,000 gallons, it was necessarily stopped.

To unwater the mine, it was decided, after several other schemes had been proposed, to put in electrically driven pumps, and the method by which this was done shows very prettily how motor-driven pumps may be adapted to suit the most trying conditions.

The object sought was the emptying of the mine as quickly as possible, and then the maintenance of a sufficient pumping installation to take care of the water as it came in. As the mines had been filled up, it was necessary to adopt such a system as would best draw out the water as the level was gradually lowered. The plan adopted was to drive centrifugal pumps by means of direct-connected, high-speed electric motors. These pumps are designed for handling water against high

heads, and the motor and pump are mounted so that they can be lowered in the pit as the level of the water falls. This arrangement is easy to carry out, so far as the motor is concerned, it only being necessary to suspend it in the pit and feed it through a cable mounted upon a suitable drum. As the pump is lowered, it is necessary only to increase the lengths of the delivery pipe. This plan made it possible to let down powerful pumps through small pits, a special design of motor being made for this purpose. Moreover, to take advantage of the comparatively low lift at the beginning of the work, certain of the pumps were constructed for pumping against a head of about 400 feet only. When the level of the water falls below this, two of the pumps are to be connected in series, and when the mine has been completely drained, the unnecessary part of the equipment can be taken elsewhere for similar use. The extent of this equipment is indicated by the sizes of the pumps, which are driven by motors ranging from 750 horse-power to 250 horse-power, drawing their supply from a turbine-generating station with a total output of 3,000 kilowatts.

With these powerful pumps it should not take long to unwater the mine completely, and it is difficult to see how a simpler solution could have been devised. The motors driving the pumps are of the three-phase induction type, probably more or less immune to water. In fact it would not be difficult to construct them so that they could be run while submerged. Indeed a year or so ago an accident in a mine in South Africa flooded the pumps, which in that case were also driven by such motors, but these machines were actually put to work and pumped out the water apparently without suffering any damage. At the Lindal mines, however, there was no need for submerging the motors, as the arrangement adopted enabled the pumps to follow the water with but little trouble.

MEETINGS AND PAPERS.

Not long since we expressed the hope that at the coming meetings of the technical societies the number of papers would be limited so that discussion would not be crowded out. It was some cause for regret, therefore, that at the recent meeting of the American Electrochemical Society the fault of too many papers was most pronounced. This meeting was, in a way, one of the most successful that the society has held. The registration was large and a number of papers of unusual merit and interest were read. As, however, there were but two short sessions for the reading and discussion of the papers, those of most interest suffered, as well as the others. The discussions were necessarily brief and did not afford opportunity to bring out clearly the opinions of those who took part. Moreover, there is no doubt that a good many who might have added something of interest forebore on account of the shortness of the time.

It is easy enough to find fault with our present system of conducting meetings, but it is more troublesome to suggest a remedy. It is true, however, that a number of the papers presented at this last meeting, which were of interest, would have found suitable position in a number of technical publications. Practically every branch of electrical engineering to-day is represented by some journal, and it would seem that papers which are merely records of work done and not expected to provoke discussion, could properly be published there and not take up the time of a meeting which the greater number of those present would prefer to devote to some topic of more immediate interest.

Another solution of this difficulty might be the accepting for publication in the society's transactions of such record papers, with the understanding that they be presented at the meetings merely by title. In a good many cases reading by title is necessary anyhow, and the practice might be extended without in any way detracting from the interest of the meeting. It must not be forgotten that one of the primary motives for holding a meeting is to provoke discussion, and there is no other method so likely to defeat this end as crowding the sessions with a large number of papers.

THE FIRST TRANSATLANTIC WIRELESS MESSAGE.

A recent issue of *The Fourth Estate,* New York city, contains a brief note giving the claims of several New York newspapers in regard to securing the first transatlantic message on the occasion of the opening of the Marconi system. Three morning papers, on October 17, published messages each purporting to be the first transmitted to a newspaper.

In view of this contention it may be interesting to review briefly Marconi's record for transatlantic transmission.

On December 15, 1901, Mr. Marconi announced that he had succeeded in receiving signals at Signal Hill, Newfoundland, which signals had been sent out from his station at Poldhu, Cornwall, England. The distance between the two points is about 2,200 statute miles. These signals consisted of a single letter of the alphabet—the letter "s"—repeated at intervals of five minutes.

On December 21, 1903, Mr. Marconi announced that intelligible messages had been received at Cape Breton, Nova Scotia, from Poldhu for some time previous, and that he had succeeded in sending messages from Cape Breton which had been received at Poldhu.

On March 30, 1903, the *London Times* published two messages of over 100 words which it had received from its New York correspondent, sent by means of the Marconi system. The paper also stated that an arrangement had been made with the Marconi company for transmitting news day by day between the old world and the new.

On October 14, 1907, the Marconi system was formally opened for commercial service, and since then messages have been sent, apparently with reliability. In advancing from each of these steps to the next a great deal of work was necessary, and many difficulties had to be overcome which were not all of a scientific character. Other systems, it is said, have also established communication across the Atlantic, but at the present time the Marconi system is the only one which is receiving commercial messages.

CONVENTION OF THE WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS.

ST. PAUL, MINN., OCTOBER 22, 23 AND 24.

The third annual meeting of the Western Association of Electrical Inspectors was called to order in the assembly room of the Ryan Hotel, St. Paul, Minn., on the morning of October 22, at ten o'clock, by President Waldemar Michaelsen, the roll-call showing an attendance of about thirty-five inspectors.

President Michaelsen in his address pointed out that every year presents new phases in electrical work and that safeguards which were adequate a few years ago are not considered safe now. He called the inspectors' attention to their responsibility for the safety of the city as far as electrical wiring is concerned and to the all-important matter of absolutely safe wiring in public buildings. President Michaelson advocates the installation of choke-coils, on all wires on alternating-current systems, where they enter buildings.

In the absence of the chairman, J. H. Montgomery, the report of the committee on the National Electrical Code was read by Fred. G. Dustin, of Minneapolis.

Only the suggestions recommended by the committee were considered separately, the suggestions not so recommended being accepted as reported, not approved.

The approved suggestions of general interest are as follows:

The prohibition of all classes of wiring in show windows except approved conduit work.

A rule forbidding the dead-ending of a four and one-half-foot run on a cleat-type socket or rosette.

A rule requiring petticoat insulators or waterproof conduit on all interior work where water collects or condenses.

Add in the Code specifications for waterproof sockets and fixtures in damp places.

Require manufacturers to furnish as a component part of all portable fans, etc., a certain length, say ten feet, of approved portable cord.

A requirement for lamp bases to be protected from accidental contact by persons handling the lamp.

Require wiring in refrigerating rooms, paper mills and other locations exposed to dampness to be in drained conduits or on petticoat insulators.

Rule 3. New clauses requiring switchboards to have main switch, main cutout, ammeter, voltmeter and ground detector.

Rule 12-g. Change the last sentence of the fine print note so as to read: "The outer or weather end of conduit is to be provided with an approved device having wires separated and bushed through porcelain."

Rule 13-a. Make grounding of transformer secondaries compulsory when primary exceeds 550 volts.

Rule 14-b. Add following sentence: "For wires smaller than No. 8 Brown & Sharpe, split knobs shall be used and tie wires and knobs will not be approved."

Rule 14-c. Add a note to indicate a method of insulating a splice on low-potential work which would be approved.

Rule 14-d. Change rule so as to permit the use of flexible tubing over iron beams in concealed-work tubes that would be liable to be broken. Referred back to Code committee for amendment, with instructions to report to the executive committee. Executive committee empowered to act.

Rule 14-e. Omit last sentence, which gives inspector power to permit wires in contact with pipe.

Rules 18 to 20. Do not allow the use of series-arc lamps.

Rule 21-c. Omit the words "in plain sight or," thus requiring all cutouts to be enclosed in cabinets.

Rule 22-a. Provide that service switches shall not be less than twenty-five amperes' capacity.

Rule 23. Provide that portable heating apparatus above a certain capacity should be provided with a special plug so as to prevent its use in an ordinary socket. Referred back to Code committee, with instructions to insert a clause providing for separate circuit for this class of apparatus.

65. Low-potential systems. Page 42. Italicized note: Subdivide this explanation so as to approve of three different classes of construction, *viz.:* 0-125 volts, 125 to 250 volts, and 250 to 550 volts.

Rule 24-a. Fine-print note. Specify what are approved barriers for 300-volt work.

24-c. Change to read: "Wires must not be laid in plaster, cement, or similar finish, or in masonry of any kind, unless enclosed in approved metal conduits, and must never be fastened with staples." Flexible tubing should never be used for protecting in place of the metal conduit called for in this rule on account of the liability to absorb moisture. Referred to committee on interpretation of rules.

Rule 24-e. Add a note reading: "Conduit required in all unfinished basements."

Rule 24-h. Require one-inch clearance from metal ceilings in open work. Referred to committee for rewording.

Rule 24-n. Permit use of slow-burning weatherproof insulation in conduit exposed to heat in dry places.

Rule 24-u. Require "flexible tubing at combination fixtures to be fastened by tape, or otherwise, to the gas pipe."

Rule 26. Add a requirement for movable canopies so as to permit inspection of spliced and insulating joints.

Rule 26. Require fixtures in places exposed to moisture to be of conduit with outlet boxes and double-braid wire and installed as a complete conduit system. Referred back to committee for more specific requirements.

Rule 45. Add a new section giving specifications for approved stage cables such as are required by the theatre rules.

Rule 54-c. Add this sentence: "Flexible tubing may be used as bushings if run in continuous lengths from the last porcelain support outside to first one inside the box or flush up to base of fittings, *i. e.*, cutout or switch."

The secretary and treasurer, William S. Boyd, reported the association on a firm financial basis with a balance in the treasury. The largest items in the year's expenses have been for publication of reports and information bulletins mailed to the inspectors. Mr. Boyd reports a membership of 160. This shows a gain of twenty-six members since last year.

The appointment of a nominating committee was referred to the chair, who named for this service: F. H. Moore, Indianapolis, Ind.; H. E. Bloomer, Milwaukee, Wis.; F. R. Daniel, Indianapolis, Ind.

Mr. H. C. Harris, chairman of the Committee on Theatre Wiring and Show Equipment, read the committee's report which entered exhaustively into the details of the subject. Stage, pockets, flexible cord for portables and moving picture machines were discussed at considerable length

A dinner was served to members at the Ryan Hotel at two P. M. by the St. Paul inspector, Mr. Varnam and friends of the association.

The morning session Wednesday, October 23, was opened with the paper by Hugh T. Wreaks, secretary Wire Inspection Bureau, New York city, entitled "Flexible Cords for Pendants."

Mr. Wreaks's paper gives evidence of deep research on the subject of insulating materials for flexible cords and other wires. The necessity for devising some means of making flexible cords mechanically secure to plugs, sockets, rosettes, etc., other than that of knotting the conductors and relieving the conductors of all mechanical strain at contact points was established. An exhaustive discussion of wools and other materials for flame-proofing cords and means of preventing the slipping of the usual braided outside protection was given. The use of swivels on flexible cords for smoothing irons and other side-wall attachments was advised. The desirability of an approved cord for moist or wet places was brought out.

Mr. Wreaks was followed by Dana Pierce, electrical engineer Underwriters' Laboratories, Chicago, with an address on "Approved Electrical Fittings." In brief, Mr. Pierce's paper was as follows: The laboratory man must depend for his field knowledge largely upon advice and criticism from the experience of the inspectors. Commercial conditions as well as technical requirements must often be considered in making rulings.

An approved electrical fitting is, first, one which has been examined and tested by the laboratory and found to be constructed in agreement with the provisions of Class D of the National Electrical Code and with the standards of good construction and practice collected by the Underwriters' National Electric Association and the laboratory from previous examinations and tests and from reports of inspection departments, manufacturers and users of electrical appliances. Secondly, the "approval" granted by the association upon the recommendations of the laboratory is

evidence that its maker appreciates the desirability of submitting his product for the review of those presumably best qualified by position and experience to judge it in relation to the fire hazard. The manufacturer obligates himself by formal contract to continue making the device as submitted, that is, to maintain the original standard in material, design and construction.

The laboratories also carry on a factory inspection and label service on a variety of classes of electrical products.

It is hoped that in due time the label service will be extended to cover all lines of staple goods. If it is the part of wisdom and prudence to demand "approved fittings," it is certainly equally wise and prudent to demand labeled goods. Through the efforts of the laboratories the bases of incandescent lamps have been standardized to a length of fifteen-sixteenths-inch and all approved receptacles have an adequate depth to cover all live metal parts. During the last year there has been considerable discussion of rheostats and motor starters by manufacturers, inspectors and underwriters. Some of the changes introduced as a result of the laboratories examinations on these lines are the elimination of glue, paste or varnishes tending to add fuel to a flame once started in the rheostat box and the substitution of porcelain parts where these glues and varnishes were formerly used. A change in the coating on resistance wire such that when the wire is overheated there shall be less inflammable gas thrown off. The addition to certain types of pans and shields preventing the ejection of sparks or molten metal. The addition of magnetic blow-outs to many types. Strengthening springs governing no-voltage release and stiffening cases to prevent short-circuiting of the coils by bulging. Braided coverings on lead-in wires have been abandoned where possible and all leads disposed so as to reduce flaming under test. The published list of approved fittings has grown from a pamphlet of 24 to one of 66 pages in the last two years.

Mr. Pierce closed his address with an invitation to all the inspectors to visit the laboratories and become acquainted with the methods employed.

H. B. Gear, general inspector of Commonwealth-Edison Company, Chicago, Ill., in a paper entitled "Joint Construction Pole Lines," said in part: The ever-increasing number of poles in the streets of many of our cities has resulted in much dissatisfaction. The most aggravated condition is brought about by the placing of one or more pole lines on each side of the same street. This arrangement is not only objectionable from its unsightliness, but the service wires from poles on one side of the street serving customers on the other, crossing over, under and through the leads on the side of the street served, as the various heights of the poles necessitate, invite contact crosses between lines, often of great difference of potential, thus endangering life and property.

As a remedy for this too great multiplicity of poles and the dangerous proximity of wires of different voltages, is offered the joint occupancy of pole lines.

The use of a single line of poles by more than two companies is not advised, for obvious reasons.

The line carrying high potentials, such as the lines of the lighting and traction companies, should be placed near the top of the poles and the telephone or other low-potential lines arranged below.

The stronger and heavier wires, being those of high-potential circuits, are less likely to break and fall on the wires below than would be the small wires of the telephone companies.

Describing joint construction as practiced in Chicago, Mr. Gear stated that the division of expense on new construction is arranged for on the basis of the number of gains occupied by different companies interested.

An arrangement for maintenance costs, proportional to the ownership interests of the occupying companies has also been arrived at.

Joint construction makes a saving of from fifteen per cent to twenty per cent on new work.

Where higher poles are necessary to accommodate a new company on an old line, the cost of reconstruction is about the same as that of separate construction.

The companies find joint construction so advantageous that it is given preference even where no saving in first cost is made.

The Commonwealth-Edison Company and the Bell Telephone Company have demonstrated the desirability of joint arrangement by their common use of 25,000 poles in the city of Chicago and have established joint occupancy as a safe practice by a seven years record with hardly a single case of serious accident to persons or property.

In the absence from the city of Paul Doty, vice-president of the St. Paul Gas Light Company, his address on the subject of "Electrical Inspection from the View Point of the Central Station" was substituted by the reading of a letter, addressed to Mr. Doty, by Fred R. Cutcheon, superintendent of the electric department of the same corporation.

In substance the letter said that the central station management desired, and was pleased to see enforced, rules requiring the best and safest forms of electrical construction.

Leaving all humane and sentimental reasons aside, safety, convenience and cleanliness are the best arguments for the adoption of electricity for illumination when competing with gasolene, acetylene and kerosene.

A more exhaustive inspection of old installations was recommended and the point brought out that some more durable form of insulation than rubber for wires should be allowed for special locations where rubber deteriorates rapidly.

The undesirability of enclosed fuses, unless inspection is followed up continuously, was asserted. Mr. Cutcheon said: "The inspectors are very rigid in regard to the fusing of new work, yet within a short time we find the enclosed fuses abandoned, frequently replaced by copper wires wound around the clips or inserted under the terminal screws. Such changes are not discovered until some trouble results and they neutralize the elaborate precautions taken in the initial inspections."

It is recommended that the electrical inspectors prevent so far as possible and correct, through their columns, all false reports printed in the newspapers of fires originating from electrical causes.

When rules are changed or new rules made the companies interested should be notified, to avoid confusion.

The standardizing of all approved appliances is hoped for, in order that the supply houses may carry an adequate stock of wiring supplies.

Appreciation is expressed of the valuable work of the inspectors and encouragement offered for the continuance of the good work.

Charles M. Mauseau presented a paper entitled "Electrical Inspection from the View Point of the Telephone Exchange."

The electric lighting and telephone companies have a common interest in securing the best inspection, with the protection of life and property for its object.

When the association or an individual inspector is called upon by a municipality for a recommendation as to what changes should be made in an existing plant of an operating company, the life and value of

the present overhead system should be given consideration before suggesting their replacement with underground construction.

Most companies will be willing to accept the dictates of the electrical inspector, as to how renewals should be made, if the companies are allowed to use the aerial lines which the municipality has given permission to construct, to the termination of the natural life of these pole-lines.

Insurance companies should be willing to give a properly guarded telephone plant, up to a specification, a lesser rate than the poorly protected plant, but seem to have but one rate for all.

Satisfactory joint occupancy of pole-lines by one telephone company and one electric lighting company may be possible, but never by a third company.

Minnesota's state fire marshal, Edward Peterson, made a brief visit to the association and delivered an extemporaneous address so full of wit as to elicit the most enthusiastic applause. In defending electric wiring from the too frequent blame it received for starting conflagrations he suggested that any one prejudiced against electricity for lighting on the grounds of fire hazard should be invited to try to start a fire in his stove with crossed electric wires for kindling.

Thursday, October 24, the last day of the convention, was essentially a day of reports. The session opened with the report of the Committee on Show Window and Display Lighting, and was followed by reports of other committees.

The Committee on Show Window and Display Lighting calls attention to section E, No. 28, of the National Electrical Code, which prohibits the use of flexible cord in show windows, except when provided with an approved metal armor. The committee endorses the wisdom of this regulation. Some inspectors are of the opinion that, inasmuch as the conditions prevailing in the average show window are closely approximated in many other instances, this rule should be amended so as to deal with the general risk involved in this class of construction rather than the single hazard attending its use in show windows. Others contend that the particular instance noted suffices for all purposes to indicate the conditions under which the use of such cord is considered dangerous, and should therefore be considered sufficient warrant for its prohibition in all places where like conditions prevail. Incorporated into a law or ordinance the rule in question would, in all probability, be interpreted according to its plain terms, the exact nature of which appears to exclude any possibility of their being intended to apply other than in a specific sense. The committee recommends this question to the consideration of the National Electrical Code Committee and to the members in general. The committee considers that good material, efficient workmanship and suitable design are the recognized characteristics of standard electrical construction. These qualities are especially desirable in show-window wiring, where, by reason of the extra hazard involved, standard construction only should be permitted. The abuse to which wiring in show windows is subjected by reason of constant changes in dressing, in a space usually of a restricted nature, renders the installation of open wiring, by reason of its rapid deterioration, a most expensive form of construction. The use of molding, in addition to the fact that it should not be used in a damp place, is open to similar objections. Nails and screw eyes are found puncturing the capping and forming electrical connection with the enclosed wires. The capping of the molding is often found in a broken condition, and is sometimes missing entirely, thereby allowing the wires to come in contact with each other. The molding is frequently placed in such close proximity to the window pane as to absorb condensed moisture from the glass, which ultimately impairs the qualities of the insulating covering of the wire. The committee leans toward the exclusive employment of iron conduit for show window wiring. Where the installations are permanent the task is simplified. The greatest trouble comes from temporary and special display lighting. This class of construction increases defects. The temporary display in show windows is considered a particularly bad hazard, because of the general tendency to use ordinary pendant cord for all purposes; to place inflammable material against the lamps, sockets and wires, and the possibility of receptacle shells being grounded by metallic tinsels, wires, etc. In decorating windows for special display, also, the use of decorative paper, celluloid ornaments, cotton batting and light fabrics of various kinds is made. After a show-window display has been arranged, the electrical equipment receives little attention until it is to be taken out, for which reason a small fire would not be discovered. In the formulation of a special ordinance to govern these matters, it seems that rigid enforcement on the part of the municipality is the only reasonable guarantee of safety which the citizen may have. It would seem advisable, by reason of the extensive character of the hazard, not to confine the provisions of such an ordinance to the dangers arising from decorative wiring only, but to so word it as to decrease the general risk to life and property growing out of such displays. The misplaced confidence which owners of buildings put in inexperienced persons in the installation of electrical displays has been attended with great sacrifice. It would seem that the adoption of an ordinance whereby all those who wish to engage in such work will be required, after demonstrating their competency, to register with the inspection department, will be the most feasible method that has so far been suggested. By holding all parties concerned to strict compliance with the provisions of this ordinance, and by providing adequate penalties for its violation, it is believed that ignorant or irresponsible persons will be deterred from further endangering the welfare of the community.

The report of the Committee on Instructions to the Public Concerning the Safe Operation and Maintenance of Electrical Wiring was presented by F. B. Spencer, chairman. The report considers that, in general, the public is of the opinion that electrical phenomena are too mystifying to be grasped without a great amount of study. In order to overcome prejudice and indifference it is necessary to expend a great amount of time, and consequently considerable money. Having determined to follow out a systematic plan of instruction, the inspector must ascertain the maximum amount of time which may be devoted to the plan. Three schemes, each demanding different time requirements, present themselves: first—regular semi-annual or annual reinspections; second—regular annual or two-year period reinspections supplemented by leaflets of information and instruction: third—the distributing of leaflets bearing on special topics, and the giving of short talks before social and business clubs. The committee has arranged four lists of suggestions or instructions to the public which, it is intended, should be printed upon substantial cards and securely pasted in prominent locations, such as the door of the cutout cabinet and near the motor rheostat. The lists of instructions are intended to cover lighting, motor and smoothing-iron equipments. A list has also been pre-

pared for the special benefit of the employer or property owner.

The report of the Committee on Wiring for Electric Cranes was presented by W. J. Gilsdorf, chairman. This committee sent out two circular letters to the members, asking them to report all accidents which were due to defects in the electrical equipment of cranes. They were also asked to make such suggestions as they deemed proper to improve electric crane equipments. After studying all the suggestions offered, the committee is of the opinion that the maximum degree of safety can be obtained by adopting the following regulations:

A main switch which will cut off all current supply to the crane and sliding contact conductors should be placed in an approved cabinet, located at a point on the building which is easy of access to the operator when standing in his cage underneath the crane.

Another switch which will disconnect all motors should be placed in an approved cabinet and so located as to be within easy reach of the operator while he is facing his controllers. The handle of this switch should protrude from the cabinet, so as to allow the operator to open and close same with the least delay possible.

Circuit-breakers should be installed on motor-circuits, but not in place of main switch mentioned in first suggestion. This makes the present practice of not providing switches for individual crane motors conform to the code.

Resistance units should be mounted on non-absorptive insulating supports, and should be entirely enclosed in a fire-resistance enclosure, or if not enclosed should have a clearance of at least twelve inches from any combustible material.

Conductors to which a sliding contact is made should be in the shape of a rigid rail, properly insulated and fastened with due allowance for expansion.

The motor frames and the entire frame of the crane and tracks should be permanently and effectively grounded.

All conductors on the body of the crane other than those to which a sliding contact is made, should be armored cable or flexible conductors encased in metal conduit.

Controller contacts, switches and fuse blocks should all be enclosed, so as to prevent the operator from coming in contact with live parts of the system.

All motors should be of the enclosed pattern.

All motors should be provided with brakes which will be held open by the current, so that in case of failure of supply current, the motors will immediately stop.

The limit switch should have a quick break.

The report of the Committee on Laws and Ordinances was presented by William S. Boyd, chairman. The committee has endeavored to find a correct solution of the problem involved in the supervision of electrical wiring in and by the municipality having a population of less than 10,000. It seems that the only comprehensive and universal solution consists in the establishment by the state of a department of electrical inspection equipped with a corps of competent electrical inspectors, whose services could be arranged for by the small municipality upon the payment of an estimated annual charge to be based upon the probable amount of work to be performed during the year. In this way one inspector could take care of a number of small cities, and through an equitable distribution of the expenses, no heavy burden would be placed on any one of them in maintaining the service. Many of the small cities have expressed an interest in the subject of electrical inspection, and would be glad to avail themselves of an opportunity to secure the services of a competent inspector at reasonable rates. Several state legislatures have considered license regulations under which it was proposed to require all persons engaged in the business of installing electrical wiring and apparatus within the state to have three years' experience as a contractor or wiremen and file an indemnity bond and pay an annual fee of $25. It is believed that a properly drawn bill would have the general support of all interested, and it is probable that such a measure will be prepared for consideration two years hence. The committee has drafted a master electrician's ordinance suitable for municipalities. The city of Toledo, Ohio, is testing the "certificate of registration" plan mentioned in last year's report. Under its provisions journeymen and contractors are required to register at the inspector's office. So far good results have been obtained. There seems to be an impression abroad that approved metallic conduit systems for wiring are the only suitable ones for concealed work in the business district of the city, where buildings of a considerable size predominate. It is entirely possible that state laws covering the use of electricity in public and semi-public buildings will be readily adopted, especially where state boards of public service exist, or where other officials are charged with the safety of the community from fire and panic. The state fire marshal of Ohio has already assumed control of the electrical hazard in theatres.

The report of the Committee on Architects' Specifications was presented by F. H. Moore, chairman. Much of the confusion brought about by means of improper architects' specifications covering the installation of electric wires and apparatus would be avoided if a better understanding could be established between the architects and the inspection bureaus having jurisdiction.

The report of the Committee on Outside Wiring was presented by Waldemar Michaelsen, chairman.

The committee is not prepared to take definite action on the matter of joint occupancy of pole-lines for low and high-potential circuits. It will be easy to make an iron-clad rule that high and low-potential wires should not be carried on the same poles. There are conditions, however, where it is almost impossible to keep such classes of conductors separated. Rather than to make a rule which must be violated, thereby setting a precedent for violation of other rules which could be conformed with, the committee does not desire to make final recommendation in this matter, but merely states its views. The committee believes that the joint occupancy of pole-lines would be considered safe when low-potential wires are enclosed in standard lead-covered cables supported in an approved manner by messenger cable, provided this cable be run below the high-potential wires, and provided, further, that the messenger cable and the lead sheathing be permanently grounded in an approved manner. No wire smaller than No. 6 B. & S. gauge should be approved for high-potential lines. Bare wire should be used for all current of a pressure above 5,000 volts, provided such lines are supported on insulators approved for their respective voltages. Leads of this kind should be at least thirty feet above ground, and should never be brought closer than twenty feet to any building or structure other than the supporting structure. The committee recommends also that cross-arms for all circuits above 5,000 volts be not secured in the usual manner by using two iron or steel braces contacted together at the heel. If braces are used, only one should be employed for each cross-arm. The committee is in favor of grounding all transformer secondaries. It suggests the necessity of state or interstate inspection of outside wiring, as considerable of this is not done according to the rules of the National Electrical Code.

The nominating committee reported the following nominations for the coming year:

President, E. R. Townsend, Chicago.

Vice-president, G. D. Boyle, Chicago.

Second vice-president, H. C. Harris, Columbus, Ohio.

Secretary and treasurer, William S. Boyd, Chicago.

The secretary was instructed to cast one vote for the convention for the complete list of nominees and their election was announced from the chair.

A vote of thanks to the officers of the association was taken before final adjournment.

Electric Heating.

If in the past electric heating and cooking have been neglected as a branch by which the central station's and contractor's efforts were capable of development, such a taunt scarcely applies to the present day, for there are unmistakable signs of activity in this department of electrical work. But the possibilities can only be realized by at first judiciously selecting those domestic features which lend themselves most easily, and with greater economy, to the introduction of electricity, and confining attention to means for the development thereof before spending time and money trying to introduce complete electric cooking kitchen outfits. The chief object aimed at should be to dispel the exaggerated notions of the expense attached to electric cooking which the average householder entertains, and this is only possible by pushing the simpler cooking devices among those who are already using electricity for lighting in such a manner that the actual amount and cost of current consumed in cooking will be evident to the householder. Thus, having gained an entrée into the kitchen, and demonstrated the hygienic and economic advantages of electric cooking, the application should find little difficulty in extending under the pressure of efficient canvassing. Happily, the particular attention which manufacturers are giving to the details of electric cooking outfits is likely to help still further in the development of electric cooking and heating. Many manufacturers guarantee their products for quite a long time, but one of the drawbacks is that enamel is largely used in the manufacture of cooking devices, and, owing to the unsatisfactory nature of enamels at high temperatures, chipping and cracking are unavoidable. A problem that has also to be faced in complete cooking outfits is whether the utensils should be separable from the heating elements, and the provision of good plugs and receptacles for the use of heavy currents as are required in electric cooking. Various apparatus designed for boiling and frying which we have seen denote a considerable improvement upon former types. In most cases frying pans and the like are air-jacketed, and the arrangements are such that a uniform temperature is obtained over the whole of the surface on which the heat is required. The risk of breakdown due to accidental overheating is consequently diminished. One of the most popular and successful of electric heating applications is the electric flat-iron. Its convenience and cleanliness outweigh the cost of operation, so that its use in commercial laundries is to be commended. From the report of such a laundry using electric irons we gather that "twenty per cent more work can be done by electric heat, and all the work is of one lustre of finish." In another case thirty per cent more work per operator could be performed. One of the most difficult problems in the whole range of household applications is the heating of water for washing by electricity. This is because of the large amount of energy required. With small quantities of hot water required in small families it may be feasible, but in large establishments the heating of large quantities of water electrically can scarcely be recommended at present. Time, however, will bring improvements in its train; and with the specially low prices charged for current for electric heating and cooking, the elimination of the objectionable features attendant on the use of coal, gas and oil stoves, the high-heat efficiency of electric as compared with other forms of heating, the development of this branch of business promises to be of importance to the central station and the contractor. —*Electrical Engineer, London.*

Marion Electric Association Exposition.

Arrangements have been about completed for the electrical show to be held in Marion, Ind., by the Marion Electric Association during the week of November 18 to 23. The show will be open to the public from 2 P. M. until 10 P. M., each day, and no admission fee will be charged.

Manufacturers and jobbers will make exhibits through their local agents as follows:

Marion Electric Supply Company—Erner & Hopkins Company, heating devices, motors, lamps and wiring supplies; Westinghouse Electric and Manufacturing Company, motors and generators; Toledo Chandelier Company and Western Gas Fixture Company, chandeliers and fixtures; Yoerger Sign Company, electric signs; Emerson Electric Manufacturing Company, fans and sewing machine motors; Reynolds Dull Company, electric sign flashers.

Marion Railway, Light and Power Company—General Electric Company, electric kitchen in operation, electric flat-iron and heating devices, regular and Gem high-efficiency incandescent lamps, motors and motor-operated machines, electric sewing machine motor; Emerson Electric Manufacturing Company, small motors, buffing lathe, dental lathe; Advertising Mirrorgraph Company, electric advertising novelties; Nineteen Hundred Washer Company, motor-driven washing machine; the Holophane Company, Holophane shades and reflectors; Electric Renovator Company, electric house-cleaning machine; Helios Manufacturing Company, flaming arc lamps; American Battery Company, rectifier for charging automobile ignition batteries; Weston Electrical Instrument Company, precision instruments for testing purposes.

C. W. McClain Company—Stand lamps.

Ohio Novelty Sign and Electric Company—The Bryan-Marsh Company, incandescent, Gem high-efficiency and tantalum lamps; the F. Bissell Company, sewing machine motors and wiring supplies; W. B. Brown Company, wood, gas, electric and combination fixtures; W. G. Nagel Company, electric appliances of all kinds; Toledo Chandelier Company; Moran & Hastings Manufacturing Company; Cleveland Gas and Electric Fixture Company, art glass domes and fixtures; Macbeth-Evans Glass Company, fancy globes and shades; Fort Wayne Electric Works; Wagner Electric Manufacturing Company, motors and motor-operated appliances; the Angell Electric Manufacturing Company; the Dull Flasher Company, and electric signs of all kinds of the manufacture of the Ohio Novelty Sign and Electric Company.

Free Engineering Library to Open Evenings.

On and after Wednesday, November 6, 1907, the reference libraries of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, and the American Institute of Mining Engineers, 29 West Thirty-ninth street, New York city, will be open evenings until nine o'clock on all week days except public holidays. These libraries, constituting practically one library of engineering, situated near the New York Library, in the new headquarters of the engineering societies, are available to members of the above societies, engineers and the public generally, subject to proper regulations. Strangers are requested to bring letters of introduction from members or to secure cards from the secretaries of the respective societies.

Automobile Shows in New York City.

The last two weeks have seen two of the best automobile shows ever held in New York city. The first was held from October 24 to 31, at the Grand Central Palace, and was the eighth annual exhibition of the Automobile Club of America. The American Motor Car Manufacturers' Association was affiliated with the Automobile Club of America in this exhibition. The Association of Licensed Automobile Manufacturers held its eighth annual show at Madison Square Garden from November 2 to November 9.

As usual, the manufacturers of gasolene and steam vehicles preponderated, with but few exhibits on the part of makers of purely electrical carriages. The exhibit of electrical accessories, however, was more complete than ever before, and indicates the rapid development of electrical appliances in automobile work.

Among those exhibiting at the exhibition of the Automobile Club of America were the following:

Ampere Manufacturing Company, "Best" dry cells for automobiles and stationary gas-engine work.

American Electric and Novelty Manufacturing Company, "Ever-ready" dry cells and specialties.

Atwater Kent Manufacturing Works, ignition apparatus, meters and switches.

Connecticut Telephone and Electric Company, spark coils, switches and indicators.

Dayton Electrical Manufacturing Company, dynamo and storage battery charging system, showing the new 8-s sparking outfit.

Joseph Dixon Crucible Company, various forms of graphite products, particularly as applied to lubricants for automobile service.

Eastern Carbon Works, dry cells and patent battery connectors.

Electric Storage Battery Company, Chloride and Exide accumulators.

Heins Electric Company, induction coils, switches and waterproof cabinets.

National Carbon Company, "Columbia" dry cells and special batteries for automobile work.

National Battery Company, ignition batteries and battery parts.

C. F. Splitdorf, unit and multiple spark coils.

Western Electric Company, battery charging dynamos and motor-generators for automobile service.

Among the electric cars exhibited were those of the Lansden Company, Newark, N. J., and the Anderson Carriage Company, Detroit, Mich.

At the exhibition of the Association of Licensed Automobile Manufacturers, electric carriages were shown by the Babcock Electric Carriage Company, the Baker Motor Vehicle Company, the Columbus Buggy Company, the Pope Motor Car Company, the Rauch & Lang Carriage Company, and the Studebaker Automobile Company.

Among the manufacturers exhibiting at this show were the following: Atwater Kent Manufacturing Works, Autocoil Company, Connecticut Telephone and Electric Company, Dayton Electrical Manufacturing Company, Eastern Carbon Works, Electric Storage Battery Company, General Vehicle Company, Gould Storage Battery Company, Geiszler Brothers, Hyatt Roller Bearing Company, Hess-Bright Manufacturing Company, Kitsee Storage Battery Company, Motsinger Device Manufacturing Company, Merchant & Evans Company, National Carbon Company, National Battery Company, Pantasote Company, Remy Electric Company, C. F. Splitdorf, Shelby Steel Company, Stackpole Battery Company, Western Electric Company, and the Witherbee Igniter Company.

BOOK REVIEWS.

"The Motorman and His Duties." Ludwig Gutmann. Sixth edition, revised and enlarged by Lawrence E. Gould. Chicago. The Wilson Company. Cloth. 196 pages. Illustrated. 5½ by 8 inches. Furnished by the ELECTRICAL REVIEW for $1.50.

This book is a revision of a hand-book prepared some years ago, which was carried through five editions. It has been the object in this sixth edition to bring the matter up-to-date and to include in it instructions necessary for the successful care of the newer types of equipment. While the greater part of the work is necessarily given up to a discussion of the car equipment, methods of caring for it and the proper way of operating the car, the authors realize that for intelligent care of the car the motorman should have a little idea of the physical laws governing the electrical apparatus and of the methods by which these are applied, not only in the motor itself but at the generating station from which he draws his power. This part of the work is necessarily brief, but, considering the space available, is unusually clear. In the discussion of the motor itself, no attempt is made to teach the motorman the fine points of motor design, but he is given a good idea of how the thing is constructed, how it is attached to the truck, how the power is applied to it, and how he should handle his controlling apparatus so as to secure the best service. The different methods of starting and the means of carrying them out through the controller are clearly explained, including the multiple-unit system. This part of the book is followed by a useful chapter on the operation of controllers, which not only tells a man how he should use his apparatus, and why, but what means he has to fall back on in case of accident. The chapter on brakes should also be very helpful. This explains not only the more common types of hand-brake, but the various forms of power brake. The book concludes with a brief chapter on troubles and with a glossary of the technical terms with which the motorman should be more or less familiar. To the motorman who intends to make a success of his work this book can be thoroughly recommended. It is clear, authoritative and up-to-date.

"Electric Railways." James R. Cravath and H. C. Trow. Chicago. American School of Correspondence. Cloth. 154 pages. Illustrated. 7 by 9½ inches. Furnished by the ELECTRICAL REVIEW for $1.

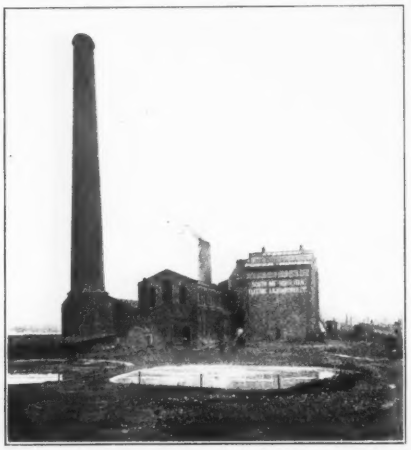
This book has been prepared with the idea of furnishing a practical working guide for the student of electric railway practice. The method of treatment is entirely practical, it being assumed that the student has sufficient elementary theory to enable him to follow the subject as it is presented. The work opens with a description of the car equipment, which not only explains the standard systems in use, but also those special applications which have of late attracted so much interest. In this part of the book every equipment is taken up and discussed in detail. Following the car equipment, the construction of the car itself, including the body and the trucks, is taken up. The second part of the book describes line and track construction, distributing systems, power generation and distribution, and the general principles of operation. Instructions are given here for locating faults, testing and making minor repairs. The concluding chapter of the book gives a brief description of the single-phase alternating systems. The whole subject is treated with the idea of imparting as much useful information as can be done when dealing with such a large subject in a small book.

South Metropolitan (London) Power Station.

By Albert H. Bridge.

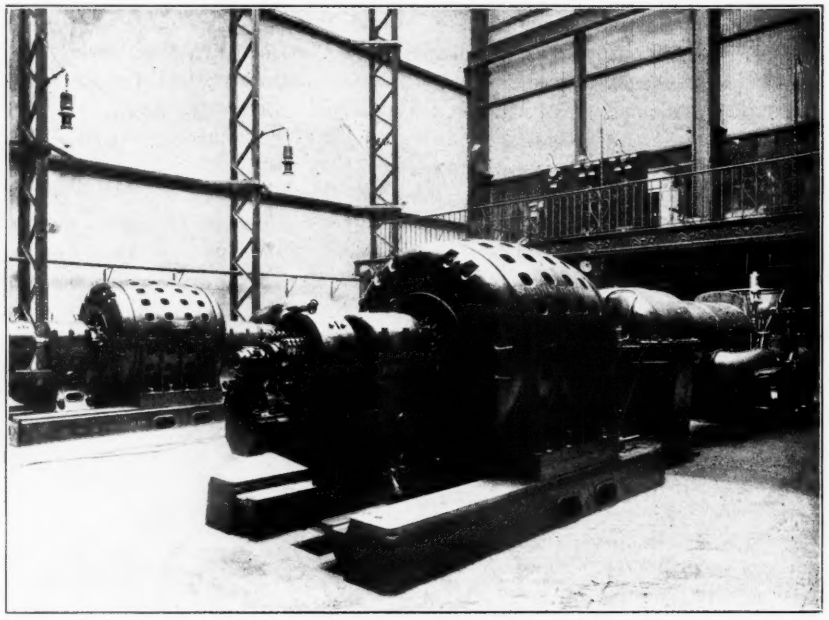
WHATEVER may be the course pursued during the next year or two in dealing with the future power requirements of London, it is of interest to note the efforts that are being made by the existing supply authorities in the metropolitan area to meet increasing demands. In a previous article it was shown that some of the companies have a fairly large margin of plant capacity which, given the demand, they would be only too pleased to employ in meeting the additional needs of power and light consumers, notably the Charing Cross & City Company, at Bow, and the Metropolitan Electric Supply, at Willesden.

If one may judge the silence that pre-

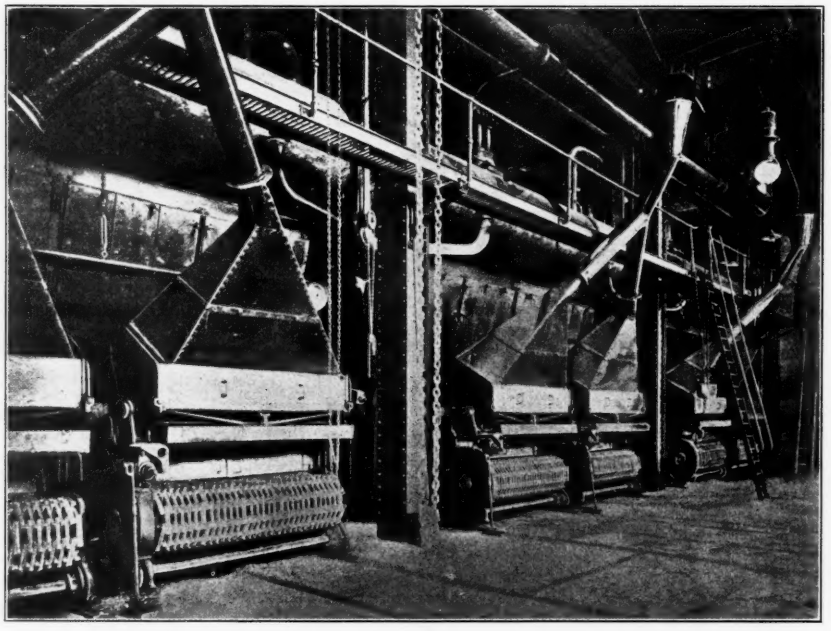


View of Exterior of New Power-House at East Greenwich, South Metropolitan Electric Light and Power Company.

vails in the newspapers concerning future schemes as indicating that no new projects are on foot, then the companies would appear to be likely to go ahead with their joint scheme unhindered by any further parliamentary conflicts with private promoters. But it is a little too early to arrive at such a conclusion. It is true that the London County Council is said to have had enough of power bill promotion, and has no disposition for another taste of such a costly extravagance. It has also been reported in several responsible organs that private parties have wasted more than they like in promotion expenses, with fruitless results, and are unlikely to try again. But there is the important question concerning what the government will do when the companies come forward with their combined mutual assistance scheme again, if they do so next year, with their claim for lengthened concessions in return for the greater facilities of cheap power supply that they hope to offer under the proposed altered arrangements. The increasing disposition which the present government is showing, and will probably continue to show as it becomes older, for the interests of private investors in public undertakings, indicates that the existing electric light and power companies will be allowed to develop their own undertakings by cooperative working, and without the intervention of other parties anxious to secure a particular class of consumer. The probable needs of the great railways for electric power may be again the subject of a joint proposal on their part, but nothing has come to light on the subject lately.



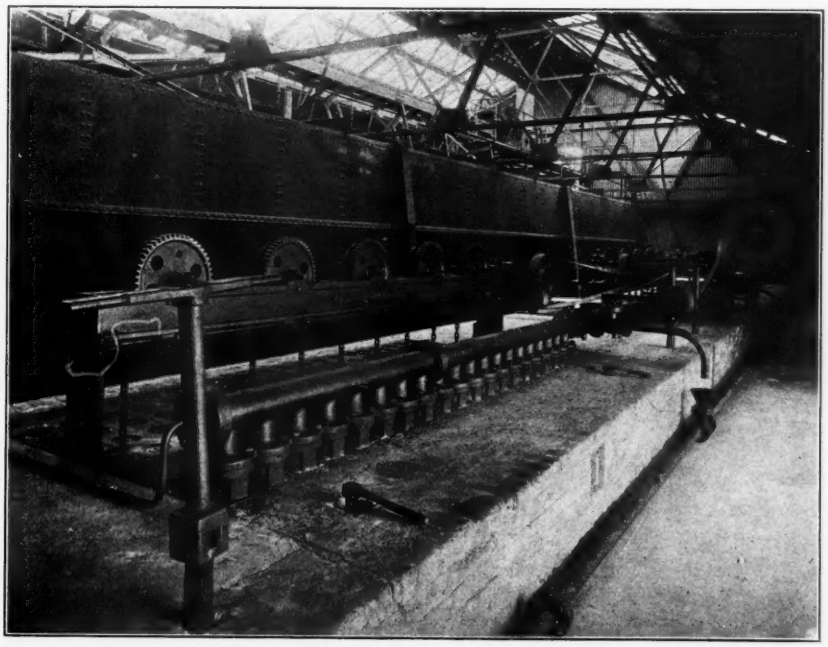
Engine Room, South Metropolitan Electric Light and Power Company, East Greenwich.



Boiler House, South Metropolitan Electric Light and Power Company, East Greenwich.

Reference will now be made, in some detail, to the efforts that are being made by the South Metropolitan Electric Light and Power Company, Limited. From a dividend-paying point of view this has been one of the least successful of the London companies. Its operations commenced in a small sort of way some seven years ago, but, bit by bit, it has added to its area, partly by securing new provisional orders and partly by absorbing an old-standing concern which supplied Crystal Palace District. In 1903 it also secured powers to supply energy in bulk to tramways and adjoining electric supply undertakers who might desire it. The potentialities of this position are evident from a study of the surrounding territory which shows what a large number of other supply areas hem in the company's original area.

CONVEYER SYSTEM OVER COAL-BUNKERS, SOUTH METROPOLITAN ELECTRIC LIGHT AND POWER COMPANY, EAST GREENWICH.



ECONOMIZERS AND COAL-BUNKERS, SOUTH METROPOLITAN ELECTRIC LIGHT AND POWER COMPANY, EAST GREENWICH.

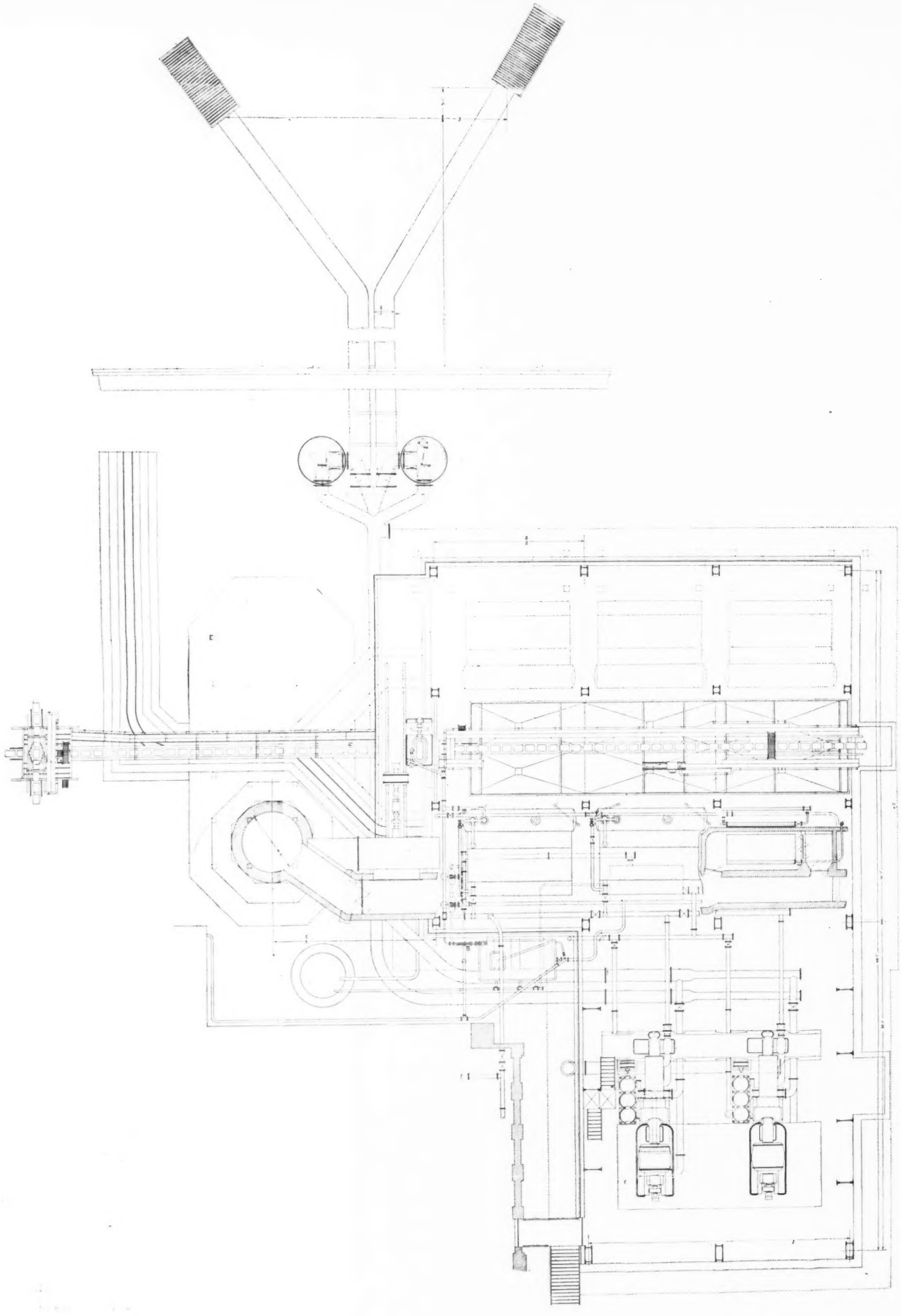
When it was observed, a year or two ago, what an admirable opening there might be in the future for the company if an enterprising course were pursued which would testify to the ability of the company to handle the cheaper supply business in an enlightened way, it was arranged that Henry W. Bowden, the managing director and engineer-in-chief, should make a tour of inspection, visiting all important power-generating stations in the United Kingdom and on the Continent as well. The result of this investigation was the decision to follow, to a large extent, the lines laid down by the St. Denis power station, which was erected for the purpose of furnishing energy very cheaply to the Paris Metropolitan Railway, and in bulk to some of the Paris lighting systems as their concessions become available.

The site of the South Metropolitan station then operating was only a few hundred yards from the very favorable position selected in the administrative scheme, and it was very advantageously situated for cheap production, having a large area of freehold land (total two and one-half acres) available for extensions, with a river-side wharf for the cheap unloading of fuel, and an abundance of water for condensing. These, of course, are advantages which a number of the other London companies could not possibly secure, owing to their being obliged to erect their stations in a restricted area or parish. The new station was therefore proceeded with on the site referred to at East Greenwich, by the side of the original plant. The building appears on the right in the photograph of the station exterior.

It goes without saying that, having an eye to the future, Mr. Bowden designed his station in such a way as to admit of easy and ready extension at low cost. The north wing is intended to have a capacity of 10,000 kilowatts, and the south wing of 22,000 kilowatts. The layout has been designed for a twenty-five per cent overload (continuous working), making a total capacity of 55,000 horsepower.

At present the coal is unloaded from barges alongside the quay directly into the bunkers, but later, as more fuel has to be handled, a deep-water jetty will be built so that ships of 1,500 to 2,000 tons can be discharged, with a very appreciable reduction per ton in the cost of handling.

The building is 118 feet by 116 feet by 40 feet in height to the eaves, of steel construction. It is erected on a concrete float of three feet thickness, supported on piles. The Alphons Custodis chimney (eighty



PLAN OF THE PLANT OF THE SOUTH METROPOLITAN ELECTRIC LIGHT AND POWER COMPANY, EAST GREENWICH.

feet in height by ten feet diameter) is carried on a separate concrete float, five feet thick, supported on piles.

The boiler house has at present three Babcock & Wilcox water-tube marine-type boilers, each having an evaporative capacity of 20,000 pounds of water per hour at 200 pounds pressure. Electrically driven improved chain-grate stokers are fitted to each boiler, and the speed can be varied from six feet to twenty-seven feet per hour. Each boiler also has a Babcock superheater provided with a special damper gear for regulating the superheat from forty degrees to 200 degrees Fahrenheit. There are three Green fuel economizers of 160 tubes each, mounted above the boilers, and these have electrically driven scrapers.

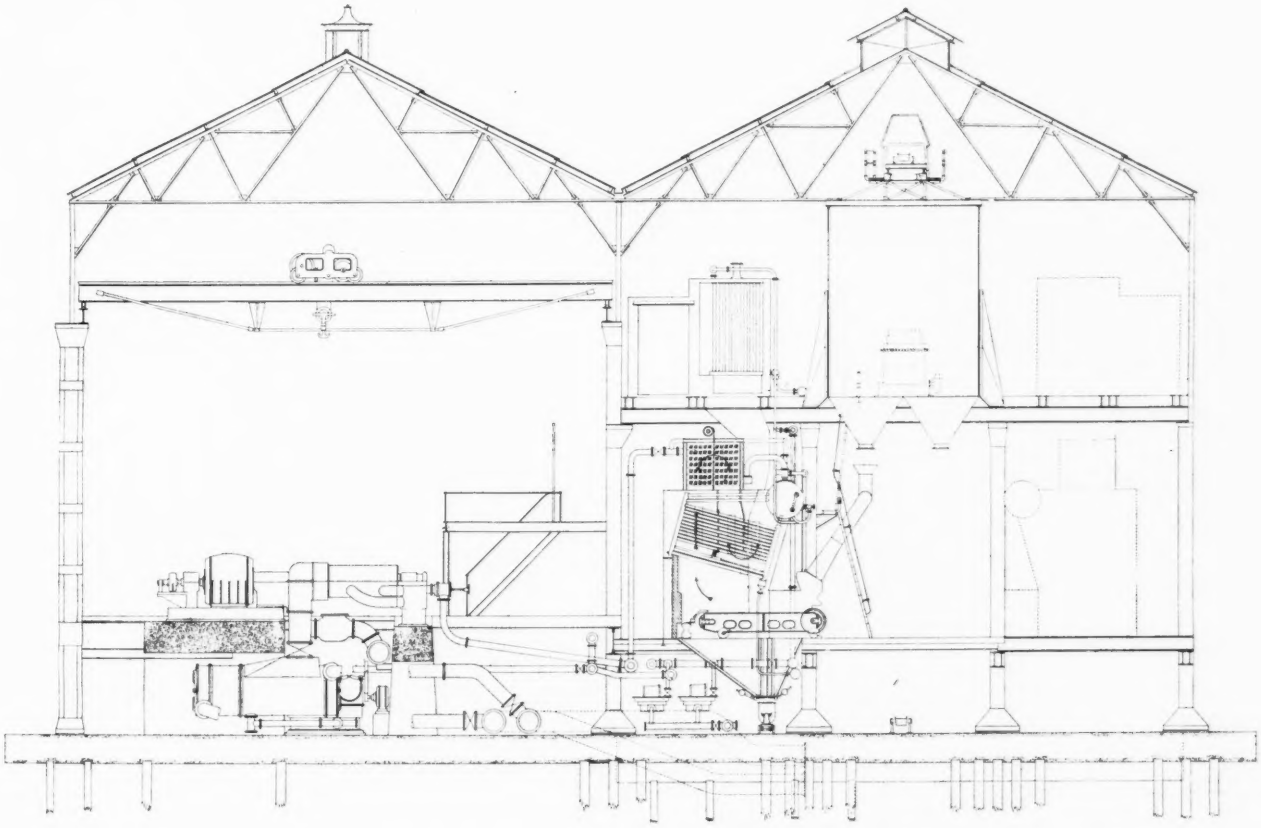
An induced-draft fan fitted between the main flue and the chimney is capable of maintaining a suction draft of two inches (water gauge). The coal bunker (600 tons capacity) is overhead and is intended to supply also three additional boilers, which will be erected opposite the three now in position. A Babcock silent gravity bucket-conveyer, electrically driven, supplies the bunkers at the rate of twenty tons per hour.

Two cast-iron wells, eight feet in diameter, are sunk on the wharf front, each containing gear for controlling the supply of condensing water from the river, consisting of one Gwynne electrically driven centrifugal pump, capable of delivering 5,000 gallons per minute, and the necessary pipes and valves. There are two forty-two-inch cast-iron pipes laid from the wells to the bed of the river, 273 feet distant, and at the river end of each pipe is fixed a suction box with a special grating. Either of the pipes can be used as suction or delivery; in other words, the flow can be reversed at will, the design being such as to prevent an accumulation of mud. As complete syphonic action is obtained, the work done by the circulating pumps is considerably reduced. From the wells to the turbine house, two twenty-four-inch pipes are laid with a fifteen-inch branch to each of the condensers.

Immediately beneath each turbine there is a Mirrlees Watson condenser, which has a cooling surface of 4,600 square feet. The turbines are of the Willans-Parsons parallel flow type, directly coupled to two 1,500-kilovolt-ampere alternators, built by Dick, Kerr & Company. They run at 1,500 revolutions per minute and have direct-coupled exciters. The current generated is two-phase, fifty cycles, 3,000 volts. The company distributes alternating current throughout its area. The generating plant is designed for a twenty-five per cent overload, and fifty per cent for two hours. An artesian well 300 feet deep and eight-inch bore furnishes water supply, and there is the public water supply as a reserve. A Lassen & Hjort water softener of 2,000 gallons' capacity per hour feeds the hot-well tank. The feed pumps are of Weir's make.

The ashes from the furnace drop into hoppers furnished with valves, by means of which they are emptied into small wagons running along a track to the front of the wharf.

In regard to the switch gear work for the two 1,500-kilovolt-ampere alternators, this was supplied by the British Thomson-Houston Company, Limited. The high-tension apparatus and bus-bars are mounted in fireproof stone compartments behind the switchboard, and the fronts of the switch-cells are provided with iron doors. An interconnecting panel has been fixed, so that the turbine sets can be run in parallel with the reciprocating



Elevation of the Plant of the South Metropolitan Electric Light and Power Company, East Greenwich.

plant in the west engine house, and with the synchronizing gear for the turbo-alternators. There is an auxiliary distribution-board under the switch gallery, from which the station lighting and motors are controlled.

The end wall of the station is, of course, only a temporary corrugated iron affair. In extending it is proposed to add first two three-phase, 10,000-volt, 3,500-kilowatt turbo-generator sets in the north wing of the station, to be followed later by four three-phase, 10,000-volt, 5,500 kilowatt turbo-generator sets for the south wing. Some thirty marine-type water-tube boilers and six induced-draft equipments are among the requirements for the scheme. The area of supply in which the company has full powers is largely residential, but there is a goodly number of works and factories which will become power consumers.

The writer desires to express his indebtedness to H. W. Bowden for placing the accompanying photographs and drawings at his disposal for the purpose of this article.

The Electrification of the Arlberg Tunnel.

C. L. de Muralt, the well-known consulting engineer of New York city, has recently returned from a flying trip to Europe, where he made an examination of the Arlberg tunnel under the Tyrolean Alps, which is shortly to be electrified. Mr. Muralt has been appointed consulting engineer to the State Railways of Austria, and the work to be done under his direction will be one of the longest stretches of steam railroad electrification ever carried out either in Europe or in the United States, there being about 140 miles exclusive of the tunnel.

The tunnel is on the main line from Paris to Vienna, and is seven miles long, with steep grades from each mouth to the middle. It is planned to increase the speed of the trains passing over the line twenty-five per cent, and to increase the capacity of the road fifty per cent. Three-phase, alternating-current locomotives will be used, capable of developing 3,000 horse-power. The locomotives will be particularly adapted to this service, as when coasting down the grade out of the tunnel, they will generate and return to the system about sixty per cent of the energy used to pull the train up the grade into the tunnel.

SOME OBSERVATIONS ON THE POULSEN ARC.[1]

BY J. A. FLEMING.

The interesting discovery of Mr. Poulsen that an electric arc between a carbon and a metal electrode formed in an atmosphere of coal-gas and traversed by a magnetic field, when shunted by a condenser and inductance, as in the Duddell musical arc, furnishes a means of obtaining undamped electrical oscillations of much higher frequency than with a plain carbon arc in air, has attracted much attention from its technical application in wireless telegraphy. Having made a careful examination of the matter during the last six or seven months, the record of some of my observations in connection with it may be of interest to other physicists who are studying the arc method of exciting oscillations. The apparatus with which I have worked, constructed on the

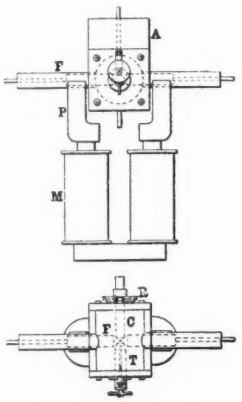


FIG. 1.—APPARATUS FOR STUDYING THE POULSEN ARC.

same lines as that of Mr. Poulsen, consists of a stout brass cylinder, fourteen centimetres in diameter and nineteen centimetres long, which is soldered across another brass box, seven inches by eighteen centimetres by twenty-five centimetres high, the cylinder being open at both ends (see Fig. 1). The interspace between the cylinder and the containing box serves as a water-jacket, and through it cold water is made to flow by inlet and exit pipes. The ends of the cylinder are closed gas-tight by marble plates, and these are pierced by holes in which brass sleeve tubes are fitted.

The cylinder has also inlet and exit pipes for coal-gas. In addition, a pair of brass tubes pass through the sides of the box and the cylinder, and in these are fitted soft-iron rods, four centimetres in diameter and twenty centimetres long. The inner ends are about three to four centimetres apart. In the chamber so constructed an electric arc is formed between the edge of a stout cylindrical carbon rod, 2.5 centimetres (one inch) in diameter, which passes through the sleeve in one marble end. This carbon is kept in slow rotation by an electric motor geared to it so that it makes one rotation in about two or three minutes. In opposition to this carbon is a hollow brass tube closed at both ends, having cold water circulating through it. This passes through the other marble end, and it is terminated by a copper beak. The electric arc is formed between this beak and the sharp edge of the rotating carbon. The copper electrode can be moved to and from by an adjusting screw, and is so set that the arc is formed in a magnetic field between the soft-iron pole pieces. The magnetic field is created across the arc by setting the brass box upon an electromagnet and joining its poles to the two iron cylinders by suitable soft-iron connectors. With this apparatus it is possible to create an electric arc of suitable length in an atmosphere of coal-gas, the arc being also traversed by a magnetic field. The carbon is the negative and the copper beak the positive pole. The field used did not exceed 1,000 centimetre-gramme-second units in strength, and generally was about 600 units. This field was so directed as to cause the arc to spring between the upper edge of the carbon and the copper beak, and be forced upwards in an arch.

Using a direct-current supply at a pressure of 400-500 volts with a suitable rheostat interposed, it is easy to form an arc having a potential difference between the carbon and metal electrode of 300-350 volts and taking five to ten amperes.

These electrodes are then connected by an oscillatory circuit consisting of a condenser made with metal plates separated by sheet ebonite, the whole being immersed in an insulating oil. The capacity of the condenser generally used by me was 0.00289 microfarad. In series with the condenser was an inductance consisting of a coil of insulated copper wire No. 7/22, wound in square form over a wooden cross, so as to make a circuit sixty centimetres in the side, having eight turns. The inductance of this coil for high-frequency currents was 116,200 centimetres. An additional sliding inductance was used, consisting of bare copper wire wound in a spiral on a wooden rod, one and one-quarter inches (3.2 centimetres) in diameter, having eight turns to the

[1] A paper read before the Physical Society, London, June 14.

inch. Two such spirals were placed on a support parallel to each other, and cross-connected by a sliding copper saddle, so that by moving the saddle, more or less inductance could be thrown into the circuit without interrupting it. The full inductance of the double spiral was 200,000 centimetres. If, then, an arc is created between the electrodes and adjusted to be of such a length as to take about eight amperes with 300-350 volts between the carbons, then powerful oscillations are set up in the square circuit in series with the condenser. A hot-wire ammeter inserted in this circuit indicated a current of about five amperes. If an electrostatic voltmeter is joined across the terminals of the condenser, we find a potential difference of 1,200 to 1,500 volts (R.M.S. value), vastly exceeding the steady potential difference of the arc electrodes.

The existence of a powerful oscillatory current in this square circuit may be shown by holding near to it a circular coil of about thirty turns, thirty centimetres in diameter, formed of well-insulated wire, to the ends of which a fifty-volt carbon-filament glow-lamp is attached. When this round coil is held near and parallel to the square coil, the lamp lights up brilliantly in consequence of the secondary current induced in the lamp coil.

It is, however, seen that the lamp often flickers a good deal, showing that the primary oscillation current is not absolutely constant, and this flickering varies with the adjustment. It is, however, possible to adjust the arc so that the glow-lamp remains fairly steady, and if its incandescent filament is examined in a revolving mirror, its image will be seen spread out into a uniform band of light.

This, however, is not an absolute proof of the uniformity of the oscillatory current. To the above-mentioned condenser circuit I then attached a long helix of fine silk-covered wire (No. 30 Standard Wire Gauge) wound in one layer of closely adjacent turns on an ebonite tube (see Fig. 2). The length of this helix was 210 centimetres, its diameter 4.78 centimetres, and the number of turns 5,470. This helix was supported horizontally on insulating stands about forty-five centimetres above the table, a sheet of zinc as long as the helix being placed on the table to act as an earth plate. This earth plate was connected to the metallic electrode of the arc and the helix to the junction point between the condenser and inductance coils in series with it.

The far end of the helix was provided with a number of needle-points formed by a bunch of sewing needles attached to a wire.

On adjusting the inductance in series with the condenser so that the whole inductance in series across the arc terminals had a value of about 215,000 centimetres, powerful stationary oscillations were excited in the helix. Under these conditions, vivid blue electric brushes, one or two centimetres long, appear on the needle points at the far end of the helix, thus showing that the potential at that end has been increased by resonance to many thousand volts. These brushes are not of the same harmless character as the ordinary electric brush of an electrostatic machine, but are veritable flames or arcs taking place into the air. They are very hot, and will melt sealing wax

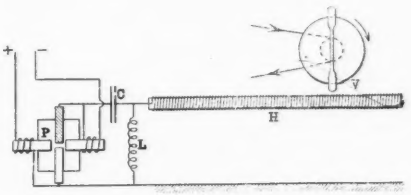


FIG. 2.—APPARATUS FOR STUDYING THE POULSEN ARC.

and set fire to paper, and inflict the most painful burns if incautiously touched. They make a rushing or whistling sound and are of a strong blue color.

If the inductance in the condenser circuit is varied even a little, the brushes disappear. The above-described helix, considered simply as an open circuit oscillator, has a natural time period of electrical oscillation of very nearly five one-millionths of a second, or a frequency of 0.197×10^6. This value had been exactly determined in previous experiments with it. As the value of the capacity in the condenser circuit is 0.0029 microfarad, and the total inductance in series with it 215,000 centimetres, the time period T of the condenser circuit is given by:

$$T = \sqrt{\frac{0.0029 \times 215000}{5.033 \times 10^6}} = \frac{5}{10} \text{ nearly;}$$

and this shows that to obtain the brush-discharge effect the condenser circuit has to be exactly tuned to the period of the fundamental electrical oscillation of the helix.

The effect of these oscillations in the wire is to create an intense electric field round the helix extending in all directions for a distance of nearly a metre. Vacuum tubes of all kinds glow brilliantly when brought near the helix. Especially brilliant is the glow in the form of Neon tube I employ with my cymometer, which, as I showed some three years ago, is extremely sensitive to a high-frequency electric field. The form of tube I use is of the spectrum type, the straight part being a glass tube with a bore of one millimetre, and the enlarged ends cylinders of about one centimetre diameter and five centimetres long.

The beautiful discovery made some time ago by Sir James Dewar that Neon and other rare atmospheric gases can be separated from the commoner constituents of air by means of charcoal cooled to very low temperature, renders it possible to fill spectrum vacuum tubes with nearly pure Neon, and such tubes are of very great utility in high-frequency research. When filled with Neon at the proper pressure they glow with an intensely brilliant orange-red light in a high-frequency field. If one of these tubes is held near the helix when in action, it shows by its glow that there is an electric field increasing in intensity all the way up the spiral to the free end.

But more, the Neon tube shows us that the oscillations are not perfectly continuous. If the tube is waved rapidly to and fro in front of the spiral, by the persistence of vision its image is expanded into a fan-shaped area of light. Examining this, we see it crossed vertically by narrow or broad lines irregularly placed. This indicates that the tube is extinguished at intervals, and this is because the electric field disappears and the oscillations are interrupted. Not only Neon tubes, but all other vacuum tubes show this effect provided they are narrow tubes. If a wide tube is used, the effect is not seen because the intermittent images of the tube overlap each other. The phenomenon is well shown by rapidly rotating a Neon tube near the spiral. The tube must be fastened by silk threads to a strip of ebonite held on an ebonite axle, and this rapidly rotated by a turn-table (see Fig. 2).

The intermittency is always most marked when the arc is first started and then diminishes, but it is always present more or less, and it shows that the oscillations, even if undamped, are not absolutely continuous, but are cut up into irregular groups. It seems to be caused by the arc changing its point of departure on the carbon electrode. It is increased if the rotation of the carbon is irregular, but I have never been able to abolish it

altogether. Another proof of the same fact is derived as follows:

The helix is removed and another square coil of twelve turns or so of insulated wire wound on a frame sixty centimetres inside is placed parallel and at a distance of two or three metres from the similar coil in the condenser circuit (see Fig. 3). This secondary coil is tuned by a condenser to the same frequency as the arc condenser circuit. Across the terminals of the secondary circuit another circuit is joined which consists of the oscillation valve or glow-lamp wireless-telegraph detector devised by me four years ago, and already described.[1] This valve stops all movement of electricity in one direction, and in series with the valve is placed a telephone. On listening to the telephone when the arc is in operation and is quite steady, a crackling sound is heard, which is not sufficiently regular to be called a musical note. If the oscillations in the arc circuit were continuous and absolutely persistent, they would induce similar secondary currents, and my oscillation valve would separate out all the unidirectional constituents, and send through the telephone a perfectly steady continuous current. But this is not the case. The telephone yields a sound which shows that the continuous current through it is interrupted irregularly, and this can only be because the oscillations in the arc circuit are interrupted. If the telephone is not inserted directly in circuit with the value, but is inserted in the primary circuit of an induction coil, or air-core transformer, the secondary of which is inserted in series with the valve, the sound in the telephone is still more increased.

We have, therefore, strong indications that the arc method of exciting undamped oscillations gives rise to irregular groups of oscillations which are separated by short intervals of time.

In order to be successful at all in producing high-frequency oscillations by the arc method, I find it essential to pay attention to a number of details. One important condition of success is, as Mr. Poulsen has already pointed out, that the carbon electrode should be kept in slow rotation. If the carbon is not rotated, a bulbous deposit of carbon soon grows on the electrode and builds up a bead or pimple of carbon which makes the arc irregular and soon puts it out. The end of the round carbon should be cut off square to begin with, but it soon gets rounded off and a little corrugated or milled, and seems to work better when it has been used for a short time. Hard arc carbons are better than soft for producing oscillations. Secondly, as regards the gas. Pure hydrogen works with difficulty. Coal-gas is better, but the coal-gas can not be used over and over again, as it is altered in composition by the arc, and this seems to create a difficulty in the use of the Poulsen arc as a transmitter in wireless telegraphy on board ship. The deposit of soot in the chamber is sometimes excessive. The coal-gas must be passed through quickly, but not too quickly, and my experience is that if the sides of the containing chamber are not kept cool, the deposit of soot is greatly increased. The more enriched the coal-gas is the worse becomes this trouble. I find it necessary in any case to clean

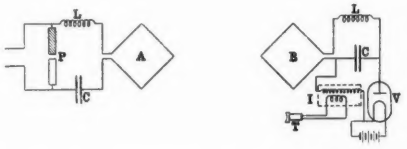


Fig. 3.—Apparatus for Studying the Poulsen Arc.

out the chamber after a few hours of continuous use. In the next place, the magnetic field requires careful adjustment. If it is too strong, the arc can not be maintained without constant interruption. If too weak, the oscillations are feeble.

The various factors—gas, field, arc-length, rotation of carbon and water cooling—all require exact adjustment to obtain the best result. In laboratory or in lecture experiments, when effects are only required for a few minutes, this is not difficult; but if the apparatus is used as a transmitter in wireless telegraphy, it must be possible to maintain constant for hours together the production of the oscillations, and so far I have not found that this is a very easy thing to do. I have tried many methods for making the arc self-regulating as to length, but without success. The best plan is hand regulation by a skilled assistant. There is a particular length of arc which for given current and voltage produces the oscillations most effectively, and this length has to be maintained constant.

When employed as a wireless-telegraph transmitter, the question which presents itself for consideration is the efficiency of the arrangement as an energy transformer. We supply the arc with continuous-current power, and we create by it high-frequency persistent oscillations in the antenna. There are several sources of energy dissipation. In the first place, the arc must be arranged in series with certain regulating or ballast resistance to permit of adjustment. I have found that very good effects are obtained when working off a 400-volt public supply of direct current or from a 500-volt continuous-current five-kilowatt dynamo. Then from fifty to 100 volts may be dropped in the regulating resistance when working with an arc of eight to ten amperes.

In the next place, there is a large production of heat in the chamber containing the arc, the greater part of which is removed by the cooling water. We have then a portion of the power converted into high-frequency current in the condenser circuit, and this dissipates itself partly as heat in the inductance and condenser, and only a fraction of this power is radiated by the antenna. We are not really concerned to know the manner in which these heat losses are distributed. We can not subject the matter to mathematical discussion unless we make certain assumptions as to the form of the curve representing the oscillations, which form has not yet been determined. I have found by experiment that the power-factor of the arc when working is not far from unity, and hence the power given to the arc in the form of continuous current can be very approximately determined by the product of the arc current and the supply voltage. For instance, in one case the potential difference of the arc electrodes was found to be 320 volts and the arc current 8.4 amperes, whilst in two separate measurements with the wattmeter the power taken up was found to be 2,632 and 2,674 watts. The product of amperes and volts is 2,688, and hence the power-factor by these measurements is 0.98 or 0.99, or practically unity.

If the current through the arc can be kept sufficiently constant, which is rather difficult, the power radiated may be also measured by the wattmeter. For suppose that we have a direct-coupled antenna joined at some point to the condenser circuit, we may then take wattmeter readings with and without the attached antenna, and the difference will be the power radiated.

In the case of the long helix above mentioned, the power given to the arc when the helix was attached to the condenser circuit was 2,674 watts, as measured by the wattmeter, and with the helix removed

[1] See J. A. Fleming, "On the Conversion of Electric Oscillations into Continuous Currents by Means of a Vacuum Valve," Proc. Roy. Soc., Lond., vol. lxxiv., p. 476 (1905). Also *Phil. Mag.*, May, 1906.

it was 2,632 watts, the arc current remaining constant at 8.4 amperes. Hence in this case it appears that the radiation and power consumption due to the attachment of the helix is forty-two watts. The measurements, however, can not be made very accurately in the case of small power radiation.

In the case of a direct-coupled antenna which is emitting a wave-length corresponding to its fundamental oscillation, the radiation can be approximately calculated from a formula given by Hertz. Hertz shows that in the case of a dumb-bell oscillator having an electric moment Q, the energy E radiated per period is given by the expression

$$E = \frac{16\,\pi^4\,Q^2}{3\,\lambda^3} \text{ ergs per period,}$$

where λ is the wave-length of the radiation.

If C is the capacity of one-half of the oscillator with respect to the other, and V is the maximum potential difference of the parts during an oscillation, and l the effective length, then $Q = CVl$.

If I is the maximum value of the current in the oscillator during a period, then

$$I = 2\,\pi\,n\,CV \quad \text{and} \quad Q^2 = I^2\,l^2/4\,\pi^2\,n^2,$$

where n is the frequency.

Accordingly,

$$E = \frac{4\,\pi^2\,I^2\,l^2}{3\,\lambda^3\,n^2} \text{ ergs per period.}$$

Now

$$u = 3 \times 10^{10} \text{ cms./sec.} = n\,\lambda$$

is the velocity of radiation.

In the above equation, I is the maximum current in electrostatic measure. If A is the ampere value of the same current, then $\frac{A}{10} = \frac{I}{u}$. If, then, the oscillations are persistent and with frequency n, the energy in ergs radiated per second from the antenna is

$$W = \frac{4\,\pi^2\,I^2\,l^2}{3\,\lambda^3\,n} \text{ ergs per second;}$$

$$= \frac{4\,\pi^2\,u}{300}\,\frac{l^2}{\lambda^2}\,A^2 \text{ ergs per second;}$$

$$= 40\,\pi^2\,\frac{l^2}{\lambda^2}\,A^2 \text{ watts.}$$

For any antenna the ratio of wave-length λ emitted to effective length l is a fixed quantity and approximates in practice for single-wire antennæ to 2.5. We have, therefore, this curious result, which does not seem to have been previously noticed, that the power radiated in watts from a linear antennæ of any length is given by the expression $W = 64A^2$, where A is the maximum value of the current flowing into the base of the antenna. If (A) is the current as read on a hot-wire ammeter inserted at that point, then

$$(A) = \frac{A}{\sqrt{2}}, \text{ and } W = 128\,(A)^2 \text{ watts.}$$

Thus, if such a hot-wire ammeter showed an antenna current of one ampere (R.M.S. value), the radiation would be 128 watts, and for the same current is quite independent of the height of antenna or the frequency.

Seeing, then, that open antennæ have such enormous radiative power, we can in practical radiotelegraphic work employ very small antenna currents when using persistent oscillations.

A complete explanation of all the phenomena involved in the Poulsen arc can hardly yet be said to have been reached. It has been shown by experiments made under the author's direction in the Pender Electrical Laboratory of University College, London, by W. L. Upson, that the characteristic curve or volt-ampere curve for a carbon-metal arc in hydrogen is a curve falling down with a much steeper slope than the characteristic for a carbon-carbon arc in air.

Also that the time during which the electromotive force can be removed without permanently extinguishing the arc, is very much shorter in the first case than in the second. Both these facts undoubtedly contribute to enable the production of oscillations of a higher frequency to be obtained with a carbon-metal arc in coal-gas, as compared with those which can be reached with a carbon arc in air.

In order that oscillations may be produced when a condenser circuit is shunted across the arc electrodes, the condenser, during its charge and discharge, must cause a variation of current through the arc, and this in turn must cause a variation in the potential difference of the electrodes in such direction as to assist the charge or discharge. Thus, when the condenser is robbing the arc of current and so decreasing the arc current, this must automatically raise the potential difference of the electrodes, and when the condenser is discharging it must decrease the potential difference. The greater this P.D. variation for a given current decrement or increment, the greater will be the energy conveyed to the condenser circuit.

In the case of a carbon-carbon arc worked at ten amperes and, say, sixty volts arc P.D., the characteristic curve is rather flat. Hence, if we employ a small capacity in the shunt circuit we have very little variation of arc current and arc P.D., and little or no energy in the condenser-circuit oscillations. We can, however, obtain more energy by using, as Mr. Duddell originally did, a condenser of rather large capacity, say one to five microfarads. Moreover, the carbon arc has a persistence which renders it irresponsive to very rapid variations of current. Hence with a large current carbon-carbon arc in air, we can only obtain rather slow oscillations.

If, however, we employ a carbon-metal arc, carbon negative and cooled copper, positive electrodes in hydrogen or coal-gas, we then have an arc with a very steep characteristic curve, and one which responds to exceedingly rapid variations of current through it. We can, therefore, employ in the shunt circuit a condenser of small capacity, and yet convey to it a considerable amount of energy owing to the large P.D. variation in the arc caused by a small arc-current variation. Hence we can produce oscillations of high frequency. This theory is confirmed by the observation that in the case of the carbon-carbon arc in air for small currents, and in the case of the carbon-aluminum arc, the characteristic curve is nearly as steep as for large-current carbon-metal arcs in hydrogen; and with these particular arcs, *viz.*, the small-current carbon arc in air and carbon-aluminum arc in air, we can obtain oscillations of high frequency.

Much further investigation is, however, necessary to enable us to state precisely the action of the surrounding medium, hydrogen, or better coal-gas, in producing this steep characteristic volt-ampere curve for the carbon-metal arc in these gases.

The Technical Publicity Association.

The Technical Publicity Association devoted its meeting of October 31 to "The Mailing List" in securing foreign business. The discussion was introduced by F. F. Coleman, advertising manager of the Lidgerwood Manufacturing Company. Steven de Csesznak, of the *American Exporter*, also addressed the meeting on this subject.

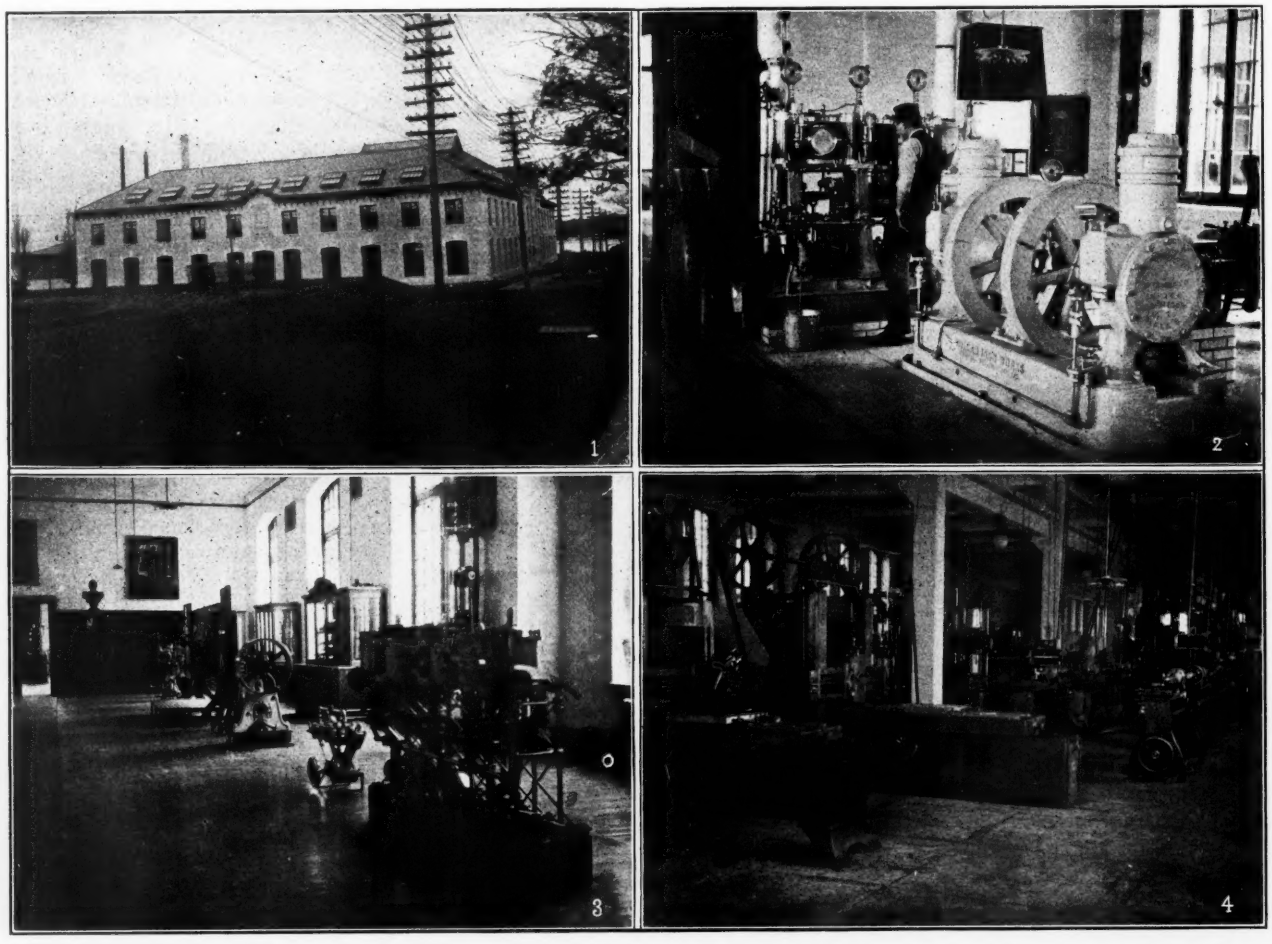
The following were elected to membership: Randolph T. Ode, Providence Engineering Works; C. Dickens Sternfels, Standard Roller Bearing Company; M. Mason Knox, General Electric Company; L. D. Gibbs, Edison Electric Illuminating Company of Boston; Walter S. Rogers, Crane Company; H. S. Snyder, Joseph Dixon Crucible Company.

It was announced at the meeting that organizations modeled on the Technical Publicity Association were being formed in Chicago, Ill., and in London, England.

Engineering and Construction at the United States Naval Academy.

By Day Allen Willey.

AMONG the new buildings of the United States Naval Academy at Annapolis, Md., the one devoted to engineering and construction is of much interest from a technical standpoint, owing to the equipment with which it is provided. It may be said that the Government has apparently spared no expense in securing the most modern apparatus for the instruction of the midshipmen, and with the academy. The main building is 267 feet in length, 175 feet in width and two stories high, except the central portion, which has a third story containing the mold loft. In addition, however, is the building occupied by the boiler room, forge shop and copper shop, which is 116 feet in length and sixty-six feet in width, connecting with the machine shop in the main building. The two structures give a total in the navy, and a variety of apparatus for testing gas and other fuel, also included in this department. Adjacent to it is what is termed the mechanical laboratory, which is one of the most complete physical laboratories in the country, as it includes air-compressors, condensers, several different kinds of ice-making machines, testing machines, pneumatic tools, as well as two engines which are merely used for instruction in taking apart, assembling and adjusting. On the ground floor is a wood-working shop in which a class of seventy-five students can be instructed at one time. This apartment opens into the machine shop, which extends the entire length of the building and is fifty feet in width.



ENGINEERING AND CONSTRUCTION, UNITED STATES NAVAL ACADEMY.—1. THE ENGINEERING BUILDING. 2. ONE VIEW OF THE MODEL ROOM. 3. WORKING MODELS OPERATED BY ELECTRICAL MOTORS. 4. IN THE MECHANICAL INSTRUCTION DEPARTMENT.

the visitor is surprised to note the number of machines installed which are of actual working size.

As the present enrollment of cadets numbers over 800, and practically all of these are given instruction in engineering and other branches, it has been necessary to provide a very elaborate set of apparatus: consequently the building and annex devoted to these branches is one of the largest and most commodious connected area of nearly 100,000 feet of floor surface, so that three hundred students can be examined at one time, and classes aggregating nearly two hundred and fifty can receive instruction in the various departments.

Upon the first floor is a room containing models, which include types of various pumps used on shipboard for air circulation, feed, etc., as well as models of valves, engines, sections of the boilers used

The second floor contains the office of the head of the department, as well as instructors' rooms, a commodious library

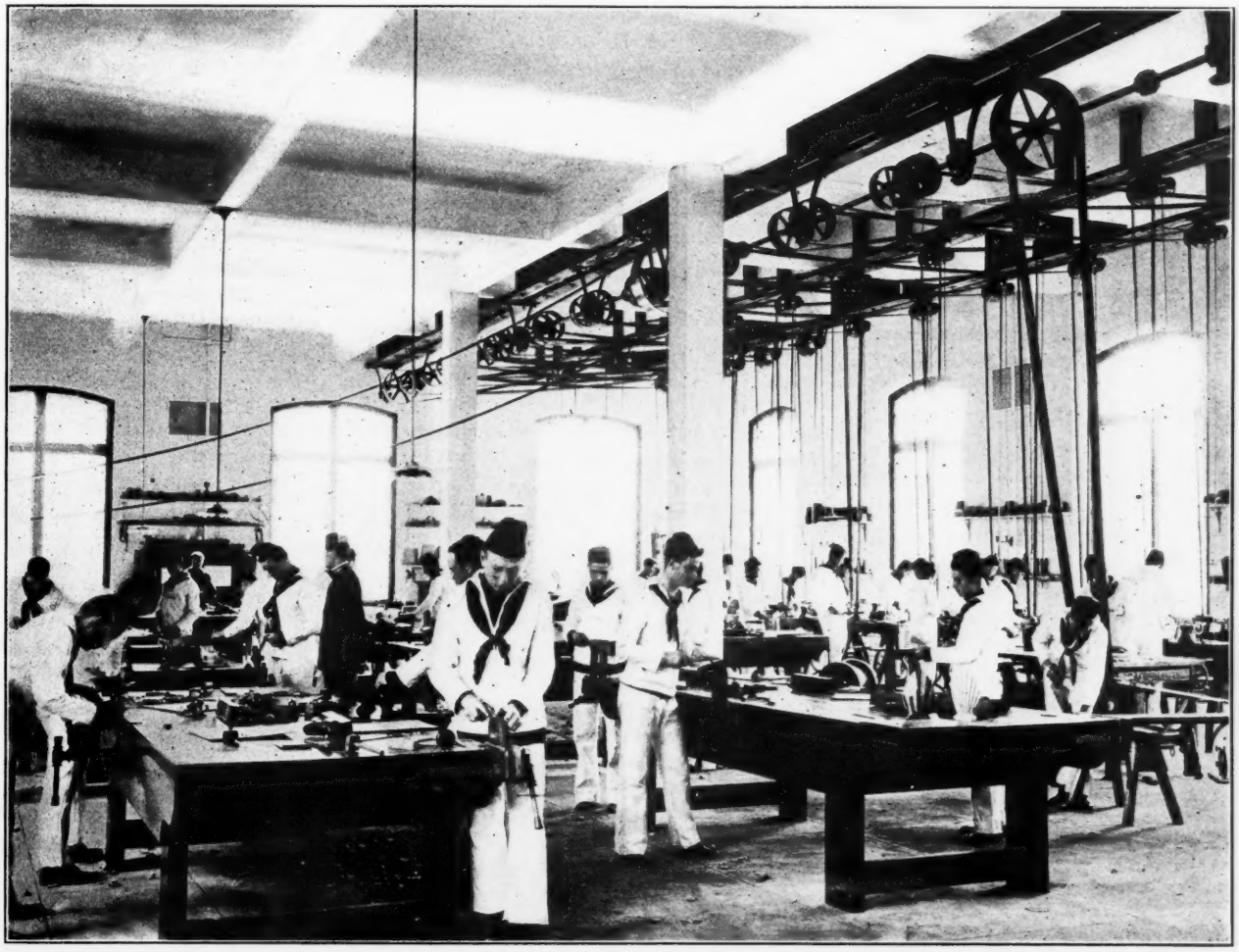
and reading room and nine class rooms, in addition to smaller apartments. The drawing room is also situated on this floor and is ample to accommodate a class of 325 midshipmen.

The installation of electric apparatus is well worthy of study, since practically all of the power tools are motor-driven, as well as much of the other machinery. The appliances in the wood-working shop, for example, are driven entirely by a Crocker-Wheeler motor, which actuates eighteen wood-working lathes, a band-saw, and drilling machine, two tool-grinders, and one drill-grinder, an idea can be gained of the extent to which electric power is utilized. In fact all of the machine tools are electrically driven, so that the boiler equipment which has been provided in the boiler shop is merely employed for operating the models of steam machines, for testing and for actuating the ice machines and air-compressors in the physical laboratory.

The building is lighted entirely by electricity and has a complete communication system by bell and telephone. All of the wires are carried in enameled iron pipe conduits, the three-wire-system being utilized exclusively with the exception of the lamp circuits, which are of two wires. In the distribution of power six circuits are employed, consisting of one set of mains for each of the following: the machine shop for the machinery motors, the wood-working shop, the model room, one to each experimental laboratory, and one for future use in a freight lift in the machine shop. These mains are large enough to supply current for all the machinery motors in use at present and for the future installation. From the office of the head of the department interior telephones lead to all the shops, class rooms, and instructors' rooms.

One of the interesting features in connection with the building is the electric blue-printing apparatus. By means of a series of lamps of sufficient power the blue-prints are made during any weather, and with a consequent saving of time. This is a great advantage in the division of mechanical drawing, where a large number of blue-prints are required.

The extensive use of electricity for power and light adds to the safety of the engineering building and its annex. The main building is of ferro-concrete construction, the exterior walls being of a light gray brick with granite trimmings. The shop and foundry comprising the annex is also of ferro-concrete construction with floors of the same material, except in the foundry, where it is necessary to have dirt. While $400,000 was expended



Model Making and Pattern Department, United States Naval Academy.

and the power-saw bench. As already stated, the machine shop is provided with a large number of tools which are of the ordinary size utilized in industrial plants. Wherever possible these are actuated by individual motors. When it is stated that the department contains fifteen lathes, ranging from fourteen-inch swing up to twenty-seven swing, in addition to two shaping machines, one drill press three sensitive drills, two milling machines, two slotting machines, one radial drill, one planing machine, one combined slotting

in constructing the engineering department, this represents only a portion of the outlay, since the amount appropriated for equipment aggregated almost as much as this sum.

Meeting of the Internationa Photometric Commission.[1]

The third meeting of the International Photometric Commission, held in Zürich at the end of July last, resulted in an agreement being reached on the question of the ratios of light standards used by the illuminating industries in Great Britain, France and Germany.

It may be remembered that the commission was first appointed at the International Gas Congress held at Paris in 1900, since which date there have been two reunions.

The larger part of the time during the three days' recent session in Zürich was occupied with the discussion of papers which were of more exclusive interest to the gas industry. It will not be denied, however, that one of the most important items on the agenda was the consideration of the reports from the national laboratories, dealing with investigations into the ratios of the principal flame standards of light. We feel the gas industry is to be congratulated on the initiation of international researches of considerable interest and value.

The only English delegates who were able to attend were J. W. Helps, honorary secretary of the Institute of Gas Engineers and chief engineer to the Croydon gas works, and C. C. Paterson, representing the National Physical Laboratory. We are glad to note that Professor Brodhun of the Reichsanstalt and M. Laporte of the Laboratoire Centrale in Paris also attended and gave accounts of the work carried out in the laboratories with which they are associated.

The three standards compared were the Carcel, the Hefner, and the Vernon Harcourt ten-candle-power pentane lamp. There were altogether four individual sets of comparisons—those undertaken:

1. At the National Physical Laboratory by Mr. Paterson.[2]

2. At the Reichsanstalt by Dr. Liebenthal.[3]

3. At the Laboratoire d'Essais et Conservatoire by M. Perot.[4]

4. At the Laboratoire Centrale by MM. Laporte and Jouaust.[1]

In researches 1, 2 and 4 the method of intercomparison through the medium of constant electric lamps was used. At the Laboratoire d'Essais, however, M. Perot adopted the plan of fixing the standards at the corners of an equilateral triangle and taking readings successively between any two of the lamps. In this way he obtained a value for the comparison between any two lamps, and also deduced the value of this relation from the ratios of the other two observations of the set. The ratios obtained in this way should, of course, be the same, but the results showed a discrepancy of about three per cent, which M. Perot attributes to error in judging between lights of different colors.

The investigations at the Reichsanstalt, the Laboratoire Centrale and the National Physical Laboratory were all carried out on the same principle. Each flame standard was in turn compared against one or more constant electric substandards and the ratios deduced from the values obtained for the electric lamps. It is interesting to note that the Lummer Brodhun photometer head was used in all the four investigations.

In the course of the discussion at Zürich on these reports Mr. Paterson said he thought it probable, from recent experience which he had had, that the pentane lamps used in the tests in Berlin and Paris had values which were slightly less than the standard lamp at the National Physical Laboratory. If this were the case, it would account for the fact that the English values for the Hefner and Carcel lamps in terms of the pentane were slightly higher than those found in Germany and France. Mr. Helps stated that the gas referees had not noticed any of the differences to which Mr. Paterson referred. Dr. Brodhun raised the point of the large difference (about four per cent) between the ratio of the English and German candles, as given in these reports, and the value of 0.88 which had been generally accepted up to now as correctly representing this ratio. Mr. Helps, while not offering any complete explanation, suggested that some of the difference might be accounted for by the use of the English candles in the earlier German investigations in a way which was not standard practice in this country. The fact, however, remains that apparently the ratio between the ten-candle-power pentane lamp and the Hefner lamp is some four per cent from the now generally accepted value.

A subcommittee was appointed, consisting of Dr. Brodhun, Mr. Paterson and M. Laporte, to consider the reports and make a recommendation to the committee on the question of the relative values of the standards under consideration.

For the purpose of the intercomparison of results, M. Laporte had previously drawn up a statement classifying various values which had been obtained for the ratios of the standard. Among these are included three sets of comparisons, through the medium of electric lamps which were tested in turn at the national laboratories of France, Germany and England.

A translation of M. Laporte's statement is given below.

Attention was called to the discrepancy which the table shows to exist between the actual comparisons of the Harcourt and Hefner flame standards and the comparisons obtained through the medium of electric lamps. Mr. Paterson stated, in connection with this point, that there had been other electric lamp comparisons in addition to those which M. Laporte had tabulated, which showed that there was a difference of between two and three per cent. About half of this discrepancy could be explained by differences in the methods of measuring humidity in the two countries, which would bring the value for the electric lamp comparisons nearer to the value of the direct measurements. In view of this the commission deemed it desirable, for the sake of obtaining uniformity in comparisons, to recommend the method which should be employed in humidity measurement. It was, therefore, decided "while not expressing an opinion upon the absolute accuracy of the ventilated hygrometer, to recommend this method for the present as probably the most accurate and consistent one for use in connection with flame standards when measurement of humidity is necessary."

The values adopted by the commission are embodied in the following resolution, which was unanimously adopted by the commission:

"The International Photometric Commission, after having heard and discussed the reports of the work carried out in the German, English and French laboratories, on the proposition of the subcommittee composed of Messrs. Vautier (president), Brodhun, Laporte and Paterson, accepts the following values for the ratios

[1] Reprinted from *Electrician*, London, October 18.
[2] Proc. Inst. E.E. Vol. xxxii.
[3] *Journal für Gasbeleuchtung*, Vol. xlix, p. 559.
[4] Bulletin du Laboratoire d'Essais, No. 9.

[1] Bulletin Soc. Int. des Elect., Vol. vi, No. 58.

of the luminous intensity of the flame standards now in use:

Carcel..... 10.7$_5$ Hefner
Vernon Harcourt..... 10.9$_5$ Hefner
Vernon Harcourt..... 1.02$_0$ Carcel

The above ratios have been chosen in order to avoid numbers which are less than unity.

These values are correct within the limits of plus or minus one per cent.

The values apply to the luminous intensity of the lamps when burning respectively under their normal atmospheric conditions; that is to say:

Barometric pressure, 760 millimetres.
Humidity:
Carcel..... 10.0 litres of water vapor per cubic metre of dry air.
Hefner..... 8.8 litres of water vapor per cubic metre of dry air.
Vernon Harcourt.. 10.0 litres of water vapor per cubic metre of dry air.

The ratios given below are deduced with sufficient accuracy from the figures already given:

	Carcel.	Hefner.	Vernon Harcourt.
Carcel.....	1.0	10.75	0.980
Hefner.....	0.093$_0$	1.0	0.091$_8$
Vernon Harcourt..	1.02$_0$	10.9$_5$	1.0

The commission subsequently discussed the desirability of making further attempts to reproduce the Violle standard, especially in view of the suitability of the high temperature furnaces recently devised by Dr. Haker at the National Physical Laboratory. It was decided to communicate with the national laboratories with a view if possible to setting on foot experiments which should lead to a satisfactory solution of this question.

EXAMINATION OF THE RESULTS OBTAINED FOR RATIOS OF THE THREE STANDARDS—CARCEL, HEFNER AND VERNON HARCOURT.[1]

STATEMENT BY M. LAPORTE.

At the last meeting of the International Photometric Committee at Zürich in 1903, Dr. Bunte, after summing up previous work on this question, gave, in conclusion, the following as the most probable values:

Vernon Harcourt..... = 11.4 Hefner
Carcel..... = 10.9 Hefner

The work done in Germany at the Imperial Reichsanstalt by Dr. Liebenthal gives as the result of the comparison of the Carcel with the Hefner the ratio Carcel = 10.8 Hefner, the Hefner being brought under its natural atmospheric conditions—*viz.*, 8.8 litres of water vapor per cubic metre of dry air.

Dr. Liebenthal has made no correction on the luminous intensity of the Carcel lamp, but he has established by direct experiments the result that the ratio Carcel/Hefner varies but little with atmospheric conditions, and that in consequence the correction to be made to the luminous intensity of the Carcel was very close to that of the Hefner lamp. Under these circumstances it is taken for granted that in the preceding ratio the Carcel is under the same atmospheric conditions as the Hefner lamp—namely, that the humidity of the air is 8.8 litres of water vapor per cubic meter of dry air. If the luminous intensity of the Carcel lamp be made to correspond with the atmospheric condition, taken as the mean in France—namely, ten litres of water vapor per cubic meter of dry air—by adopting the coefficient of correction of 0.006,[1] which applies to the Hefner and Vernon Harcourt lamps, the preceding ratio becomes

Carcel..... = 10.72 Hefner

The ratio found for the Vernon Harcourt lamp was the following:

Vernon Harcourt ..... = 10.8 Hefner

the pentane lamp being used under normal English atmospheric conditions—*viz.*, ten litres of water vapor per cubic metre and the Hefner lamp at 8.8 litres.

The results of tests made in England by Mr. Paterson at the National Physical Laboratory were as follows:

Hefner..... = 0.0914 Vernon Harcourt
Vernon Harcourt = 10.95 Hefner

Assuming that the pentane lamp was under the normal condition of ten litres of water vapor per cubic metre and the Hefner of 8.8 litres.

For the Carcel lamp the ratio found is

Carcel..... = 0.9825 Vernon Harcourt
Vernon Harcourt = 1.018 Carcel

The tests undertaken in France by M. Perot at the Laboratoire d'Essais and by MM. Laporte and Jouaust at the Laboratoire Centrale, (1) of direct comparisons of standards with each other, and (2) of comparisons obtained by the intervention of an incandescent electric lamp (corrections being applied to bring each lamp to its normal atmospheric conditions), have given the following mean results:

Hefner..... = 0.093 Carcel
Vernon Harcourt.. = 1.005 Carcel
Hefner..... = 0.093 Vernon Harcourt

Other comparisons interesting to note have been made by certain physicists who have traveled successively to Germany, England and France, taking with them the same incandescent electric lamps. By comparing the values obtained, it is possible to calculate the ratios of the luminous intensity of the standards of each country under the exact conditions under which they are used.

In 1903 Dr. C. L. Sharp, of the Electrical Testing Laboratories of New York, obtained the following results for the mean of the luminous intensity of his lamps:

Laboratoire Centrale in Paris... = 16.2 candles or 1.685 Carcel
Reichsanstalt in Charlottenburg = 18.12 Hefner

The following ratio is thus deduced:

Hefner..... = 0.093 Carcel

In 1906 E. P. Hyde, assistant in physics at the Bureau of Standards, Washington, made the same journey, and has recently published the results of his experiments. The ratios obtained by him of the means of the values of ten lamps are as follows:

Vernon Harcourt..... = 11.19 Hefner
Carcel..... = 10.73 Hefner
Vernon Harcourt..... = 1.043 Carcel

Finally, in 1907, the Laboratoire Centrale sent MM. Laporte and Jouaust to Teddington and to Charlottenburg with incandescent lamps, the results of this series of measurements being the following:

Vernon Harcourt = 1.027 Carcel
Hefner..... = 0.094 Carcel
Whence Hefner... = 0.0908 Vernon Harcourt

By tabulating these different results and by calculating the reciprocals the results of the different tests may be compared.

		Carcel.	Hefner.	Vernon Harcourt.
Carcel...	1.		10.72	(0.984)
	2.		(10.73)	0.982
	3.		(10.75	(0.995)
	4.	1.0	(10.75)	
	5.		10.73	(0.958)
	6.		(10.70)	(0.973)
Hefner..	1.	(0.0935)		(0.0918)
	2.	(0.0930)		0.0914
	3.	0.093		0.093
	4.	0.0930	1.0	
	5.	(0.0932)		(0.0894)
	6.	0.0934		0.0908
Vernon Harcourt	1.	(1.016	10.9	
	2.	1.018	10.95	
	3.	1.005	(10.75)	
	4.			1.0
	5.	1.042	(11.19)	
	6.	1.027	(11.01)	

1. German tests. 2. English tests. 3. French tests. 4. Dr Sharp, 1903. 5. Mr. Hyde, 1906. 6. MM. Laporte and Jouaust, 1907.

An examination of this table shows that the ratio of the Carcel and the Hefner lamps is in accord, and this determination seems sufficient for the ratios of the Vernon Harcourt lamp to the Carcel and Hefner lamps; the results of the three researches, German, English and French, differ by less than two per cent, but the discrepancies obtained in the comparison of lamps carried from one laboratory to another amounted to four per cent.[1]

It is difficult to say whether these errors are due to accidental errors of measurement, to systematic differences between the different specimens of the standards, or to different valuations of atmospheric conditions. Under these circumstances it seems quite sufficient to define the result of the units by two significant figures. However, as by suppressing the decimals the errors may be augmented when the reciprocal or the ratio of two coefficient is taken, it is thought that it will be useful to fix at the same time the values to adopt for the ratios and their reciprocals.

Following this method one or other of the coefficients in the appended table should be chosen:

	Carcel.	Hefner.	Vernon Harcourt.
Carcel.....	1.0	10.7	0.98
Hefner.....	0.093	1.0	0.0915
Vernon Harcourt..	1.02	10.95	1.0

It appears that by their recent researches the different laboratories have now quite established the specifications of their respective standards, and, in consequence, the values of the ratios given above may be assigned an accuracy of plus or minus one per cent.

[1] Communicated to the International Photometric Commission, July, 1907.

[1] Tests made on this subject in 1906-7 at the Laboratorie Centrale, under numerous and varied atmospheric conditions, have shown that the formula for the correction was a complex one, and that temperature seemed to play a part, the luminous intensity increasing with the temperature. Between fifteen and twenty degrees centigrade the coefficient of variation approaches the value indicated for the other standards.

[1] At Mr. Paterson's request the ratio deduced, of Pentane to Hefner, from the tests on Dr. Sharp's lamps were omitted from the tables. At the time of Dr. Sharp's comparisons the National Physical Laboratory had not established its standard of candle power, and Dr. Sharp's report on the lamps stated this fact in order that the results should not be used for the purpose of international comparisons. The figures have been omitted from the translation of M. Laporte's statement.

Electrical Notes from Great Britain.

(From Our British Correspondent.)

OWING to a large part of the electricity supply area served by the Corporation of Brighton still having a 115-volt supply pressure, it was noted some months ago that metallic-filament lamps were coming into use, as, unlike many other towns in the United Kingdom, its installation necessitated no alteration to the existing wiring. The tendency was pointed out by the engineer and manager of the undertaking, John Christie, in a report to the corporation in which it was shown that the maximum demand was being considerably reduced. Much was made of the matter in gas lighting journals. Mr. Christie says that he does not look on the development as a drawback, "as the much-improved lighting is a distinct advertisement to our undertaking, and things will soon right themselves by increased popularity."

There has just been completed an interesting electrical pumping installation at the Lindal Moor hematite iron mines of Harrison, Ainslie & Company. Altogether the company's mines at Ulverston extend over some 3,000 acres, and four of these mines, in which it was known that large ore bodies were contained, could not be unwatered by the old pumping machinery either efficiently or economically enough to obtain profitably that large output of which the mines were capable. It is confidently expected that now that this electric motor-driven high-speed centrifugal pumping plant is getting to work, the number of workmen employed will be doubled, and the output gradually increased by from four to five times. It was about four years ago that pumping operations were abandoned, and various schemes were prepared for putting pumping plants into the three shafts available in the four mines, *viz.*, the Lowfield, Diamond and two Bercune mines. The very limited dimensions of the pumpways were a considerable difficulty for the plant designers. In each of the Lowfield pits there are now installed two centrifugal pumping sets, each capable of delivering 4,000 gallons of water per minute against a total head, including friction, of 395 feet. Where the two shafts join —at a depth of 378 feet—the pumps are connected in series, and they can then deliver 4,000 gallons against a 780-foot head. They are of the one-stage type, and rest on a special iron carriage running on six-foot six-inch gauge rails. Each motor will give 750 brake-horse-power on 3,000 volts, fifty cycles per second. The speed of the combined sets is 1,485 revolutions per minute. The two Diamond mine shafts have vertical sinking three-stage pumps capable of raising 1,000 gallons per minute against a 680-foot head, and they are driven by 315-horse-power direct-coupled motors (speed 1,480 revolutions per minute). Each set is entirely enclosed in a structural-iron framing, and a rope sheave is fitted to carry the weight of the pump, motor, cable and piping when filled with water. The two five-stage pumping plants in the Bercune pits are similar in design and deliver 1,000 gallons against a total head of 540 feet. The motors are 250-horse-power. For these Diamond and Bercune mines the pumps are so designed that rapid sinking operations will be facilitated. During the first half of the draining operations not all of the impellers will be in use, so that at first the pumps will give practically double the normal output obtained at half-way stages, where all the impellers will be in action. The pumps were made by Sulzer Brothers, of Winterthur, and the whole of the electrical equipment, motors, etc., are the work of the Electrical Company, Limited, of London, the English agent for the Allgemeine Elektricitäts Gesellschaft, of Berlin.

There is a power station specially put down for the installation. It is from half a mile to a mile distant from the various mines named above. There are three 1,140-brake-horse-power horizontal steam turbo-generators of Allgemeine Elektricitäts Gesellschaft design and make, each giving a three-phase current at 3,300 volts, fifty cycles per second, when running at 3,000 revolutions per minute. There is an exciter direct-coupled to each main shaft, and a Tirrill regulator has been adopted for securing constant terminal voltage on the generator. The switchboard is of special cellular design. The front of the board is of tiled masonry and the switches mounted thereon are operated by handles. In order to insure entire isolation of the high-tension apparatus and the safety of the operator, the connections to the switch gear are made by spindles which pass through the tiled wall and drive the switch gear direct or by sprocket wheels and chains. All of the motors in the different pits are under the control of the engineer in the power station.

At a meeting of the Birmingham and District Electric Club, R. Borlase Matthews, who, during the past year, has done good work in urging upon our electricity supply authorities the necessity that exists for greater commercial enterprise in pushing the sale of electricity, read a paper on this subject in which he set out his arguments in favor of cooperative action in dealing with matter, and discussed the formation of an electrical association to do in English ways for English electrical development, what your Cooperative Electrical Development Association has done in America with American methods. In the course of his arguments in favor of cooperation he said that central stations not competing against one another were in a position where extensive cooperation could be the means of producing results exceeding the most sanguine expectations. The position of the British electrical manufacturer was criticized: "Manufacturers of electrical apparatus need to be more thoroughly awakened to the advantages that will accrue to them from a more extensive use of electricity. They are now occupying themselves chiefly in urging upon their customers the merits of the particular apparatus which they manufacture. If, in addition to this, they could be induced to put before the public the general advantages of electricity for those main purposes for which their apparatus is manufactured as an auxiliary, then the more general use of electricity would create a greater demand for what they wish to sell, and their business would be more prosperous." The preliminary movement toward the establishment of this proposed electrical association is admitted by Mr. Matthews to be beset with difficulties in England, the reasons being the long-standing and deep-rooted ideas about the necessity of constant rivalry in trade, and the prevalent distrust and suspicion to which manufacturers have become accustomed. Therefore, the author invokes the assistance of the professional and trade associations. He also had something to say about the manner in which the funds for such a movement should be provided. No doubt there will be a great

deal heard about the cooperative electrical campaign here for some time to come.

The various engineering and scientific institutions are now about to settle down to the work of the 1907-1908 session. On October 18 the Institution of Mechanical Engineers held its first meeting, at which Professor Bertram Hopkinson, of Cambridge University, laid before it a paper on the indicated power and mechanical efficiency of the gas engine. The society started off with a paper entitled "Liquid Fuels for Internal Combustion Engines," by R. W. A. Brewer. The Rugby Engineering Society devoted its first night to "Steam Turbines, with Special Reference to the Willans-Parsons Type," by E. R. Briggs. In regard to the Institution of Electrical Engineers, it is hoped that Lord Kelvin, the president for the third term, will be able to deliver his inaugural address in London early in November, but Lady Kelvin has been seriously ill in Scotland. The latest reports are that a considerable change for the better has taken place, and electrical and other scientists the world over will desire her early restoration to health. The Physical Society of London, at its reopening meeting on October 25, had before it a paper by A. Campbell on the use of variable mutual inductances, and one by Dr. J. A. Fleming on magnetic oscillators as radiators in wireless telegraphy. The post-office has its own Institution of Electrical Engineers, the new session of which was inaugurated on October 14 with an address by Major O'Meara, the engineer-in-chief to the general post-office. In the course of his observations he expressed his own views concerning the qualities that go to make up the successful engineer, more especially the engineer engaged in the telegraph service. The points particularly emphasized were: Personal equation, commercial aptitude or its equivalent, administrative ability, and the quality and extent of professional knowledge. For telegraph and telephone engineers, overhead and underground network constructors, and, indeed, all engineers it is necessary to supplement the usual technical lines of study with matters appertaining to administration, finance and general political and social economy. The major went on to detail some of the ways in which a knowledge of, or experience in, these subjects would be of great value to engineers associated with the service.

Recently a good deal has been written in technical journals on this side concerning what is termed stagnation in electric traction. The lack of development of this kind, especially on our railroads has been the cause of great disappointment to everybody electrical, and it has, of course, most seriously of all affected manufacturers, upsetting all the calculations or expectations of recent years in regard to the matter. Some remarks on the situation were made at the meeting of the British Thomson-Houston Company, Limited, in London, by the chairman, J. F. Nauheim, on October 10. In referring to the disappointing results that had attended the year's operations, he blamed the rise in prices of raw materials, the severity of competition, and the fact that heavy traction business, which formed so large a branch of the company's work, had come almost to a standstill in Great Britain. The company had contracted during the year for ten electric locomotives for the Metropolitan Railway Company, and for the electrical equipment of several trains, but that was practically all the heavy traction business done in England during the year, and he was sorry to say that that condition of things continued.

Many things have been blamed, from time to time, for the exodus of manufacturing industries from the London area. High rents, high rates, for both employer and employed; high wages, lack of an adequate and cheap supply of electric power, and last, but by no means least important, the difficulties that have been put in the way of works' owners by the London Building Act of 1894, under which certain restrictions have been imposed in regard to cubical capacity of works, and a number of constructional details making it impossible for owners of big engineering undertakings to profitably or conveniently carry on manufacturing operations according to modern principles. It is satisfactory to be able to state that the new London County Council has taken the first steps toward altering the restrictive provisions in the act named. Legislation has to be promoted for the purpose, but it is high time something were done, for a number of cases might be cited of electrical and other engineering factories being removed to the provinces, and of others being put up just beyond the council's area borders in order to get outside the act. Certain changes that are now proposed are intended to prevent other firms leaving London and to remove obstacles that now stand in the way of the establishment of new industries in the metropolitan area.

The Blackpool Corporation has just added a Willans turbine set direct-coupled to both an 800 to 1,000-kilowatt Dick-Kerr alternator for lighting purposes, and a 600-kilowatt Brown-Boveri generator for tramway power supply. This brings up the capacity of the station to 4,150 kilowatts. The works have been running for about fourteen years, and as numerous extensions have naturally taken place during that period, there are many old and new varieties of generating plant in position, these including Fowler type alternators (driven by ropes), Ferranti alternators, triple-expansion engines and some eight turbines. Charles Furness is the borough electrical engineer.

Technical Education at Cornell.

In his annual report to the board of trustees of Cornell University, Ithaca, N. Y., President Schurman, says, with regard to technical education, that no institution in the world has done more for technical education than Cornell University, nor does any other enjoy a higher reputation. But President Schurman insists on further improvement, and he believes that as the engineering courses have become entirely professional the way to improvement lies in prescribing some college work in the liberal arts before entering upon the professional courses. Men are graduating in engineering courses in the United States with an ignorance of literature, history, and the other liberal arts so dense that no proficiency in science and technology can save them from the charge of being uncultured, especially, when, as too often happens as a necessary result of their limited reading of literature, they are unable to express themselves, either in speech or writing, in correct English prose. President Schurman accordingly recommends that in the near future Cornell University at least one year and, preferably, two years of study in language, literature, history, etc., be required of candidates for engineering degrees before admission to the professional courses. He is persuaded that no improvement which could now be effected in the character of the instruction offered by the technical colleges at Cornell University could compare with the gain which would accrue to those colleges by having the minds of their students nurtured, strengthened, and liberalized as they might be if the students devoted even half their time during the first two years of the course to the English language and literature, history, political science, and other subjects of humanistic culture. This recommendation embraces students in architecture as well as students in civil, mechanical and electrical engineering.

Electrical Notes from Europe.

(By Our Special Correspondent.)

THE new electric crane erected at the military port of Bizerta, on the coast of Tunis, is the largest which has been constructed in France up to the present time. The order for the crane was given by the French government to the Fives-Lille Company, which makes a specialty of this kind of work. It is erected upon the quays of the Sidi Abdallah arsenal, and is designed to carry a load of 130 tons, while the total weight of the crane is nearly 400 tons. The load is handled at a distance of 100 feet over the edge of the quay. As to the main points of construction, the crane consists of a strong central pylon upon which is mounted a horizontal beam of iron-work for carrying the load. The beam is made to rotate about the top of the pylon upon a pivot. The length of the horizontal beam is 160 feet. Rolling upon a track along the main beam is the carriage for handling the load. It is fitted with two independent motor-driven drums. At the other end of the beam is a counterweight of 100 tons for balancing the load. One of the drums is used specially for lighter loads, ranging up to twenty tons, while the other drum runs at a slower speed and carries the heavy loads, up to 130 tons, which is the maximum capacity of the crane. Both drums are fitted with motors of forty-five-kilowatt capacity. The carriage is moved by a ten-kilowatt motor. For rotating the main arm of the crane there is a fifteen-kilowatt motor placed in the tower. An improved system of electromagnetic brakes is used.

A new company has been formed at Paris known as the Compagnie Parisienne d'Electricité and its object is the erection and operation of electric plants in the region of Paris. The formation of this company is the outcome of the negotiations which have been made by the city in order to provide for the supply of current in the future. A concession has been awarded to the new company by the city, following the recent decision made by the municipal council. That the present company is an important one will be seen by the fact that it is capitalized at $10,000,000. Its duration is fixed at a period of ninety-nine years.

Steam turbines of the Westinghouse type are to be used in a new plant which will soon be set up at Bergamo, Italy. The plant is controlled by a local company known as the Carlo Sanchi Company, and it recently placed the order for the steam-turbine outfit with the Havre works of the above-mentioned firm. One of the turbine groups will consist of a Westinghouse steam turbine and alternator having a capacity of 1,300 kilowatts and operating at 1,500 revolutions per minute. The alternator is of the three-phase pattern and is designed to furnish 7,500 volts at fifty cycles. In the plant will also be installed a steam-engine group of 600 kilowatts capacity. A Bellis & Morcom engine is coupled to a three-phase alternator of the company's make, which also delivers 7,500 volts. Both the steam turbine and the engine are fitted with Westinghouse-Leblanc condensers. In the case of the turbine, the condenser has a capacity of 25,000 pounds of steam per hour. The outfit which is to be set up in the boiler house comprises four Babcock & Wilcox boilers, with other apparatus.

It is reported from Berlin that the Japanese and Russian governments are engaged upon a project which consists in erecting a series of radio-telegraph posts throughout Siberia, so as to afford communication between the two countries by this means. It appears that the project is to be ratified at the next congress of radio-telegraphy.

St. Petersburg is to take an important step as regards the adoption of electric traction. According to the present plans, the whole of the tramway lines throughout the city are to be changed to the electric system. A large amount of rolling stock and a central station of some size will be needed to carry out this project, seeing that the total length of track in the city lines is figured at 130 miles. The change-over will be carried out within six years. The first section, thirty miles in length, is now finished. The work is being carried out by the Westinghouse company. For operating this section of the lines a central station has been located upon the Obvodny Canal, where it can receive coal from barges. Parsons turbines are used in this case, and there are three turbine-alternator units placed in the dynamo room. These turbines operate at 1,500 revolutions per minute and are rated at 2,200 kilowatts, delivering 6,600 volts at twenty-five cycles. The boiler room contains six double boilers, and the plant is also equipped with a battery of 130 cells of accumulators. Five substations are used for the line, and each of these will have a capacity of 1,000 or 2,250 kilowatts, according to its location. In the substations are installed a set of oil transformers which receive the main current from the central station at 6,600 volts. At the secondaries of the transformers the voltage is 370 volts three-phase. This is used upon rotary converters which supply direct current at 600 volts for the trolley wire. Different capacities, either 500 or 150 kilowatts, are used for the rotaries, and the machines are started up by a small three-phase motor, or else a storage battery which the station contains can be used for starting if need be. The rolling stock used upon the first section, consists of 200 motor cars. Each of the cars is fitted with two forty-horse-power motors. The old horse cars may be used as trailers.

Owing to its great height (300 metres), the Eiffel Tower is specially adapted for use as a radio-telegraph station, and to this end it now has a mast wire hanging from the summit, and upon the grounds at the foot of the tower is placed a small building with apparatus, which is under the direction of Captain Ferrié. Although the post is equipped with apparatus of only twelve horse-power, it has been very successful of late in sending signals to different points in France, and also to the Mediterranean region. Messages can now be sent as far as Bizerta, the French military port not far from Tunis. Signals were also received at the port of Casablanca in Morocco, during the recent troubles in that region, and the vessels of the fleet in the different Mediterranean ports can now communicate with Paris. It is proposed to increase the power of the Eiffel Tower plant and to provide it with apparatus of a much larger capacity, so as to increase its range of action. The opinion has been expressed by competent persons that with sufficiently powerful apparatus there is no doubt that signals

could be sent across the Atlantic so as to connect with America.

Motor-driven plants for city water pumps are now coming into use on the Continent, and an example of this kind is the recently erected plant at Milan. It was installed by the Swiss firm of Sulzer Brothers. In this case there are three separate pumping stations, which are equipped with electric motors. Current is obtained from the circuits of the Edison central station. From the pumps, the water is sent into forty-five reservoirs which are installed in different parts of the city. The water is then taken up by pumps placed at each of the reservoirs and sent at high pressure into the city water mains. Such plants can be operated very successfully, as is proved in the present case.

Among the new projects for electric railroads may be noted the line which is to run between Milan and Genoa. This will be one of the longest lines in Italy, as the distance is about eighty-five miles. The road will be double-track and standard gauge, using electric locomotives. It is expected to run twenty trains per day and an express train every two hours, allowing a total of 6,000 passengers daily. The proposed type of passenger train will have 150 tons weight and consist of three cars of fifty places each. A forty-five-ton locomotive is used, having double bogies and fitted with four 220-kilowatt motors. The maximum speed of the trains will be seventy-five miles an hour. A considerable number of freight trains will also be run between the two cities. These will weigh 700 tons and make a speed of twenty-five miles an hour. Each train will be made up of thirty cars. There will be no grade-crossings on the line. It is stated that there are to be no less than nineteen tunnels on the road, one of which is twelve miles long, and a great number of bridges will span the roads. For the current supply a hydraulic station is to be erected, which will contain apparatus to the extent of 25,000 kilowatts. The estimated cost of the enterprise is $47,000,000.

Upon the Rhine, near Laufenburg, is to be erected a hydraulic plant of some size which will utilize the power of that stream. The concession for the plant has already been granted to a syndicate formed by the Felten-Guilleaume-Lahmeyer Company, of Germany, and the Swiss Compressed Air and Electric Company, of Berne. As the plant lies near the frontier the current will be used both in Germany, in the southern part of Baden, and also in the northern part of Switzerland. It will be employed mainly for electro-chemical purposes. The fall of the Rhine has a large volume and a small head of water, the latter being ten feet, and the volume of water ranging from 260 to 5,000 cubic metres, according to the season. The present designs call for a capacity of 50,000 horse-power. There will be installed ten turbine-alternator sets of 5,000 horse-power each, besides the exciter and pump turbines.

At St. Petersburg there will be held an exposition of lighting and heating apparatus, starting in the month of December next. It is under the auspices of the Imperial Russian Technical Society, and includes methods of all kinds, in which electrical apparatus will have a prominent place. The exposition will last for two months. Its object is to show the public the comparative values of the different systems. During the period a congress will be held in which these subjects will be treated by specialists. Arrangements are being made to have the apparatus transported by the railroads at reduced rates and duty-free. A series of conferences upon leading technical questions relating to the exhibit is being arranged for by the society. C. L. DURAND.

Paris, October 26.

Union Pacific Railroad's Testing Laboratory.

One of the most complete railroad testing laboratories in the country has been completed at the new Omaha shops of the Union Pacific Railroad Company. The laboratories occupy part of the new shop office building, the offices of the chemist and engineer of tests and the test room on the ground floor being connected with the chemical laboratory on the second floor by an electric elevator. The walls of both laboratories are of pressed brick and the ceiling of wood to eliminate as far as possible trouble and annoyance from fumes.

In the test room the machinery, all of which is electrically driven, includes a 250,000-pound Riehle automatic machine for tensile tests. The records of this machine are made autographically. A similar 50,000-pound Riehle automatic machine, milling machine, shaper, lathe, drill press, hacksaw and bench grinder, are also part of the equipment of this room, which includes a complete set of apparatus for testing cement and soapstone storage tanks. The room is lighted with Cooper Hewitt mercury vapor lamps. For conveying material to the testing machine there is a tramway with chain hoists.

Every modern device for use in the work for which it is intended is included in the equipment of the chemical laboratory. In addition to the main room there are several special departments for photographic work, bacteriological investigations, electric experiments, a balance room, and a stock room for chemicals and supplies. The tables are covered with vitrified tile and the walls of the hoods are lined with white glazed tile.

For this laboratory a complete equipment has been provided of Sartorius and Troemner balances, a Berthelot-Mahler bomb calorimeter, microscopes for investigations in bacteriology and metallurgy, a spectroscope, constant-temperature ovens with thermostats, a high-pressure autoclave for experiments with boiler waters, calorimeters and standard thermometers, in addition to the usual apparatus.

Besides the routine testing, inspection, and analysis of various materials to ascertain if they conform to the company's specifications, its laboratory workers are constantly engaged in original investigations, both chemical and physical, into the properties of the various materials that come into railway engineering. One unique investigation carried out by this department was a study of weed growth, the results of which partly determined the design of the company's gasolene weed burner.

The inspection and test department of the Union Pacific has direct charge of details of various tests and inspections, not only on the Union Pacific, but also the associated Harriman lines. The inspection bureau has charge of the acceptance or condemnation of all materials purchased for the associated roads, including locomotives, rolling stock, and all maintenance-of-way materials, as well as bridge structure.

The organization of the inspection and test bureau, under the chief chemist and engineer of tests, is as follows:

An assistant engineer of test and four resident inspectors in charge of the physical laboratory. An assistant chemist with four analysts, a photographer and bacteriologist in charge of the chemical laboratory. Besides the resident chemists there are two traveling chemists who supervise the operation of water-treating plants. The non-resident force is divided into a number of districts in charge of resident inspectors.

PRESENT CONDITION OF ELECTRICAL INVENTIONS.

BY WILLIAM STANLEY.

Twenty-five years ago the phenomena accompanying the flow of electrical currents were not generally understood; to be sure, their relationship had been mathemtacally explained by physicists, but this knowledge was confined to the chosen few. The diffusion of these principles and the substitution of physical for mathematical explanation among inventors and engineers was the first step in the development of the electrical arts. Few new phenomena of primary importance have been discovered during this period and probably very few more will be hereafter, for the reactions accompanying the continuous and periodic production of the magnetic field and the establishment of electrostatic stresses now seems to us to be complete.

Our efforts during the past twenty-five years have, therefore, been focused on applying these primary principles to the production of useful forces resulting in useful work, and the record is a glorious one. We (and by "we" I mean, of course, the workers of every land) have progressed from the toy apparatus of the "seventies" to the monster power-houses of today. These results have been obtained, first, by the careful observations, experiments and tests of the inventors who have furnished the arrangement of apparatus necessary to accomplish the desired ends, and who have discovered or invented simple and reliable means for utilizing the phenomena that men of science gave them, and second, by the application of engineering methods to the development of the art. In this latter work the great corporations have been most useful, for without their aid the dreams of many inventors would have faded like visions of the night. I believe the contributions from the two sources to have been entirely distinct and independent, for the inventor has given little assistance to the development of engineering, and I know of no invention or discovery of primary importance that was born in the laboratory of a trust.

The unconscious aim (if I may use such a term) of all this work has been to offer to any man in every civilized country the one element necessary to increase his productive power—to increase the strength of his hands by muscles that know no fatigue.

The journey toward the establishment of this condition is nearly over. We are ready to systematically equip Massachusetts, for example, with electrical highways to such an extent and so perfectly that every citizen of the commonwealth can have power and its productions at a reasonable cost, and in any quantity.

The factors of the problem are well worked out; the devices necessary well understood, the engineering and construction work simplified. Reduced to its essential terms the undertaking is found to be dependent on our ability to vary the factors of the electrical energy we employ (the pressure and quantity) without unduly adding to its cost. It is now more than twenty years since the transformer demonstrated this fact and opened the door between the laboratory and the outside world. We have a right to be satisfied with the results—they are satisfactory.

What are we coming to? In what direction will our future efforts press? The dominant motive of the past generation has been centralization—the gathering together of all work of a similar character in one place—the extermination of the individual and individual efforts and the strengthening of trusts. The war-cry has been, "Thou shalt not work for thyself."

Is it possible that this era will be followed by a period of decentralization? If so, the distribution of power to all who wish for it will be the cause.

We have many problems before us—physical, problems of the laboratory—engineering problems afield, and social problems that encircle our conditions of life. To my mind the latter are the most important, for the former can only be present when the conditions of life are arranged in a satisfactory manner.

The electrical engineer has won his place beside his elder brothers, and he must assume his share of the general burden. The conditions of the average educated engineer is far from satisfactory. The extermination of all competition by the trusts has reduced his opportunities and left him largely at their mercy. Incentive to individual work has nearly disappeared, for the influence of the trusts can not now be successfully opposed. As the matter stands to-day, only the well-to-do can afford to pursue physical investigations. The artisans of the country, the bricklayers, masons and trades workers in many places, are as well or better paid than the designers of intricate electrical machinery. That is to say, manual skill commands as high a price as the efforts of the technically trained—the educated man.

In Germany the dissatisfaction of this class is a factor in the social problem. The great corporations are getting their technical work for practically nothing. Unless these conditions are changed, unless individual opportunity is again opened, we may be sure that the art, as an art, will languish. To-day the percentage of men investigating new physical principles or those attempting to apply well-known principles to the production of new appliances is far less than it was ten years ago, although the number of men trained to this kind of work is far greater, for it is now generally believed that no man can hold his own work—if it is important—can reap the benefits of his labor.

To quote one instance, a most valuable and revolutionary invention was copied before it came out of the patent office. I believe these conditions must change.

Reforms and reformers are not popular, but they are sometimes necessary. The principles of Federal rights—the theory of patentability and the methods of determining patent causes—were designed for less complex conditions. As they stand at present, they appear to have been devised to assist the unscrupulous rich to overwhelm the poor. If we are to encourage the founders of new arts, we must remedy these matters, for they are not conditions of the future, but living issues of the hour.

The Annual Report of the New York, New Haven & Hartford Railroad Company.

The annual report of the New York, New Haven & Hartford Railroad Company for the year ended June 30, 1907, shows total gross earnings from operation of $55,601,936.32, less operating expenses of $37,850,081.71. The net earnings for the steam railroad lines were $17,751,-854.61. The net earnings for the street railways were $3,615,899.69. The net earnings for the steamship lines were $635,127.22.

The gross earnings show an increase of about five per cent over the previous year. The operating expenses increased about seven per cent, due to a large increase in wages and in the cost of material necessary for the operations of the company. There was also an increase of twenty-five per cent in the *per diem* rate for the use of freight cars.

The report states that the electrification of the New York division between Woodlawn and Stamford has been practically completed, and electric service inaugurated for local trains between New York and New Rochelle, and New York

and Portchester. The complete change from steam to electric traction for all passenger service on this section has been made effective during the present month. Among the new equipment which has been contracted for is thirty-five electric locomotives, 160 open electric cars, 202 closed electric cars, four electric express cars, twenty-eight electric snow plows, and miscellaneous cars.

The merger of the New York, New Haven & Hartford Railroad Company with the Consolidated Railway Company, on May 31, 1907, added 300,000 shares of capital stock, making the total issued capital of the company on June 30, 1,218,781 shares. Of this, 247,977 shares are held in the treasury of subordinate companies, whose capital stock is all owned by the New York, New Haven & Hartford.

The properties of the Connecticut Railway and Lighting Company, consisting of 193.48 miles of urban and interurban electric lines, operating in territory contiguous to the New York, New Haven & Hartford company's electric railways, and of numerous city gas and electric lighting plants, all located within the state of Connecticut, were acquired by lease for 999 years at a varying rental from August 1, 1906, to August 1, 1914, and at a fixed rental thereafter. Purchases were also made of the stock of the Meriden, Southington & Compounce Tramway Company, of the New Milford Power Company, of the Housatonic Power Company, and of the stock and securities of the Rhode Island Securities Company. The latter is the sole owner of the stock of the Rhode Island Company, which controls, through leases, 295 miles of electric railways situated in the cities of Providence and Pawtucket, and adjacent territory in the state of Rhode Island.

For simplification of operation, the street railways, electric light, gas and water supply companies in Connecticut owned and controlled by the New York, New Haven & Hartford company have been, since June 1, 1907, operated under a contract by the Connecticut company, all of whose capital stock is owned by the New York, New Haven & Hartford company, which provides for the payment monthly of all the net earnings, which results are shown in the income account and are not included in either the gross earnings or operating expenses of the railroad company.

On May 31, 1907, by authority of the stockholders and in accordance with an act of the state of Connecticut authorizing the same, a merger was effected of the Consolidated Railway Company and the New York, New Haven & Hartford Railroad Company, under the name of "The New York, New Haven & Hartford Railroad Company."

The New York, New Haven & Hartford Railroad Company, as to-day constituted, is the owner directly of all the railroads, electric urban and interurban lines, lighting, gas and water supply companies formerly owned and operated under the separate companies known as the New York, New Haven & Hartford Railroad Company and the Consolidated Railway Company.

The Connecticut company operates 640.17 miles of street railway lines, of which 411.01 miles are owned and 229.16 miles are leased. The Connecticut company also operates gas, electric lighting, water and power plants at Branford, Waterbury, New Britain, Greenwich, Norwalk, Naugatuck, Suffield and New Milford.

The Rhode Island company operates 310.9 miles of street railway lines, of which 43.89 miles are owned and 267.01 miles are leased.

Long-Distance Wireless Telephony.

A brief description is given here by R. A. Fessenden of the apparatus which he has devised for use in his experiments in wireless telephony. By means of this apparatus it has been possible for some time past to maintain telephone communication between Brant Rock, near Boston, and New York city, a distance of nearly 200 miles, seventy-five per cent of which is overland. For this purpose an alternating-current generator is employed, which may run at a frequency of 100,000 cycles a second. The normal frequency of operation is 81,700 cycles. The open-circuit voltage of this machine is 150, and the available output is about one kilowatt. By an ingenious method of overcoming the difficulty of a narrow air-gap, machines rated at ten kilowatts may be constructed and at the same time it is possible to design the machine so as to give a frequency of 250,000 cycles a second. In operation, the transmitter is generally placed directly in series with the antenna and the armature of the high-frequency alternator. In this use, the current, with the transmitter short-circuited, is about six amperes, and with the transmitter in circuit, about five amperes. In talking from a local point near Brant Rock, speech is transmitted over a wire to the wireless station, then relayed wirelessly to New York, and again relayed over a wire to the receiving station. The type of relay employed is that known as the "trough" relay. This consists of a double differential magnetic circuit with a pivoted armature, to which is attached a spade of thin platinum-iridium, which dips into a trough containing carbon powder. The sides of this trough are formed of platinum-iridium sheet. This relay is used both for transmitting and receiving. It is very sensitive and amplifies speech about fifteen times without loss of distinctness. It will amplify fifty times, but then the speech becomes somewhat indistinct. For tuning, a variable transformer is employed, which resembles a Wheatstone rheostat, although its action is not dependent upon contact at all. It has been found that when wire is rolled on a metallic cylinder, it makes contact at irregular intervals. The metallic cylinder is, therefore, formed of an undivided tube of pure electrolytic copper, which acts as a short-circuited secondary of a transformer. When it is desired not to change the resistance, a sheet of mica is slipped between the wire and the cylinder without affecting the action of the transformer. The speech received at New York with this apparatus was about three times as audible, this during the daytime, without the use of a relay. Professor Fessenden believes that a simple system of this kind will come into extensive use on shipboard, since it does not necessitate the employment of a skilled operator, and it can be run continuously without adjustment. In fact, the system can be arranged so as to be utilized either for wireless telegraphy or telephony, the change-over from one system to the other being accomplished by the mere throwing of a switch. It is also believed that for telephoning across large bodies of water, wireless telephony will in time have the monopoly. Since it has been possible to telephone over 200 miles during the daytime with an expenditure of only 200 watts, it should be possible to telephone in the daytime between England and America with an expenditure of less than ten kilowatts. For this purpose a mast 600 feet high will be used. That used during the New York-Boston transmission was only 200 feet high. Professor Fessenden also believes that, in the future, the wire trunk lines of many present telephone systems will be superseded by wireless trunk lines. The latter are much cheaper to install and maintain than the cable systems.—*Electrician (London), October 4.*

The Clement "Automanual" Telephone Switchboard System.

The Clement "Automanual" switchboard telephone system is a combination of the old manual system and certain standard parts taken from the automatic telephone systems. The undesirable features of both systems are claimed to be eliminated, and it is stated that an actual saving of from forty to eighty per cent is effected in operation.

The equipment consists of an automatic switching outfit at the central station, operated by operators. The necessity for a subscriber's dial or sender is eliminated, and the substation telephone is identical with the standard common battery instrument used in all manual systems. The subscriber's station, his line to the central office, and the line connections on the main frame, with their protective devices, are the same as in all standard common battery equipments. The differences are within the main frame at the central office, the "Automanual" equipment being substituted for the ordinary switchboard. Fig. 1 and Fig. 2 show, respectively, the top and bottom views of the operator's equipment, consisting of keys only, and the automatic switching apparatus.

Each operator's position is equipped with controlling keys somewhat similar to those of a typewriter. Each key set enables the operator to take and dispatch one call at a time. There are only "A" operators, the system eliminating "B" or trunking operators. A subscriber calls by taking down his receiver. He is instantly connected to an idle operator. Incoming calls are distributed among the operators, and as the number of operators is increased or decreased, the distribution adjusts itself to meet the varying conditions. When only one position is in service, all calls come to that position. The operator, seeing the signal on her idle key set, takes the number and sets it up on the keys. Her work on that call is then finished. Her sole function is to take the numbers and set them up. If the subscriber wants to secure a long-distance or toll connection, or to make a complaint, or to ascertain a number, the operator adheres to her function and merely sets up the keys so as to put the subscriber through to the person or department desired.

A number having been set up on the keyboard, the switches commence to operate, and through successive steps automatically taken and directed, the line corresponding to the number set up is selected and tested, and if found idle, the subscriber is rung in the usual manner. If he is a party-line subscriber, current of the proper frequency is selected, or the proper combination is made so as to call him selectively. If the line is busy or the subscriber does not answer, the calling subscriber is automatically notified of the fact.

As soon as the switches have selected the line wanted, the particular operator's key which was employed to handle that call becomes disconnected, and all the operators are locked out during the continuance of the conversation between the subscribers. When the subscribers have finished the conversation and hung up their receivers, all the connecting apparatus between their lines is instantly cleared and restored to normal condition ready for use by other lines. This enables the lines to be called again without delay and effects an economy in apparatus and cable.

The equipment and operation of the chief operator's, monitor's, wire chief's and other auxiliary desks or position are the same as with standard manual practice.

The design of the switches and relays and the method of mounting these result in a great saving of space, and all the operators for a 10,000-line exchange, it is said, can be accommodated in a room twenty-five by thirty feet.

The system has been developed by Edward E. Clement, a well-known electrical engineer and patent expert of Washington, D. C. The National Engineering Corporation was organized by James B.

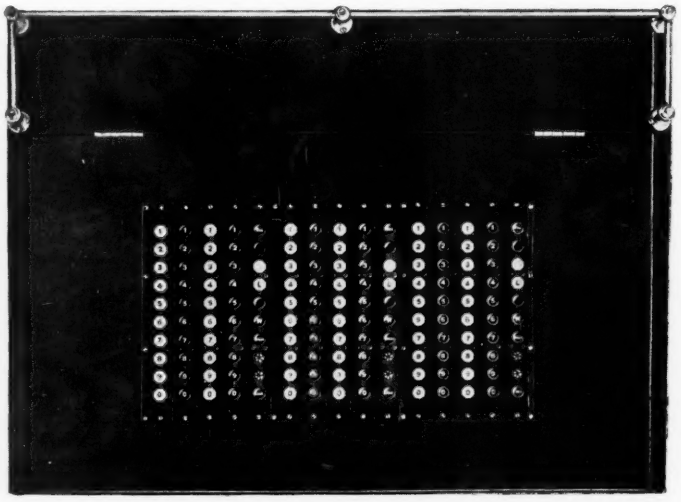


FIG. 1.—TOP VIEW OF CLEMENT "AUTOMANUAL" SWITCHBOARD.

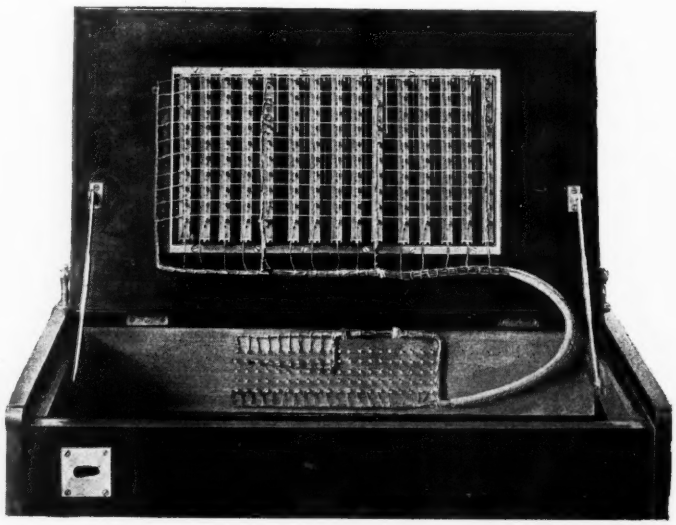


FIG. 2.—BOTTOM VIEW OF CLEMENT "AUTOMANUAL" SWITCHBOARD.

Hoge, of Cleveland, Ohio, to work out Mr. Clement's inventions, and a number of well-known operating telephone men are interested in the company. A laboratory was opened originally in Washington, a factory later being established in Baltimore, where machinery was installed and the business of manufacturing carried on. Still later, realizing that the factory in Baltimore was not properly located to handle the manufacturing business, the National Engineering Corporation consolidated August 1 last with the North Electric Company, of Cleveland, Ohio. The latter company secured complete control of the United States and Canadian patents.

A contract has been made for the installation of an "Automanual" switchboard at Ashtabula, Ohio. This will be put in operation early next year.

Electric Law.

At the recent meeting of the Kansas Gas, Water, Electric Light and Street Railway Association, held at Topeka, Kan., John C. Nicholson, president of the Newton (Kan.) Electric Light Company, read a paper entitled "Electric Law." While a good deal of the author's statements are of importance locally, there are some features which have a wider application, and the following excerpt is printed as of interest because of the lack of discussion upon this topic:

Electric companies furnishing current to the public generally and using the street for such purpose are quasi-public in their nature, and the public has certain rights with relation to the public-service corporation which it does not have with the strictly private company. Public-utility companies have no right to discriminate in charges for the same service. The legislatures and the courts are giving the people enlarged powers over all public-utility companies, and the extent to which it will go no one can tell. The only bar remaining, so far as I know, is the stand the courts have taken that the legislature or commissions created by it can not confiscate private property; in other words, that the owner is entitled to a reasonable return, but on what he is entitled to a reasonable return is still in doubt. Is he entitled to interest on his investment, or interest on the present value of the plant; and if so, what rate of interest is a reasonable return, are still mooted questions. It is admitted that the farmer may double his money each year, or the miner make 1,000 per cent each year, or the speculator even do better, but it is quite the thing to say that the owner of public utilities is only entitled to interest on the money invested. At least, not to more than a reasonable return on the physical value of the plant.

The police power is the most comprehensive and far-reaching law in this country of ours. It is subject only to the rights ceded to the United States by the constitution. Its exercise is calculated for the efficient protection, enjoyment of, the control over lives, property, public welfare, peace, health, safety, prosperity and morals, and it may protect the community against the injurious exercise by any citizen or natural or artificial person of his or its own right. This undefinable law controls the location of poles or removal of same, the stringing of wires or removal of same, lighting the streets by city or by contract, grading of streets and obstructions therein, fire protection, nuisances, etc. Ordinances of this nature, however, must not extend beyond a just regulation of rights for the public good, and when they unreasonably abridge or burden the privileges which the police power is to conserve they are invalid. Whether or not such ordinances are reasonable is for the court to decide. The police power can not be delegated or given away by franchise contract or otherwise. For example, a franchise does not permit the maintenance of a nuisance or the operation of a plant in a manner dangerous to life or property.

Cities of the first class may under certain conditions grant franchises for not exceeding thirty years, while cities of the second and third classes may grant franchises for not exceeding twenty years. Cities of either class may buy, construct and operate light and water plants, but no city is authorized to grant an exclusive franchise, and whether or not it can build its own plant during the life of a franchise to a private company is to be seen. Under the police power the city has a right to fix a maximum rate to consumers, but once fixed in the form of a contract it is binding.

Chapter 105 of the laws of 1905, provides that the lot owner may recover damages for injury to trees planted within the curb line of the street the same as if the same were planted on his lot. In Ohio, where the fee to the centre of street is in the lot owner, the court held that the lot owner had the right to have the trees remain and grow there without injury, whether such injury was necessary or not, to the use of the lines of such telegraph company. Our Supreme Court has not passed on the question. An electrical company has no power to enter upon private property for the purpose of cutting off branches of trees overhanging the sidewalk or street. If it desires to enter upon private property it must obtain permission; if not, it will be liable for trespass and damages.

The duty is imposed on the company of erecting its poles in such a manner as not to interfere with the abutting owners' right to ingress and egress, and of so constructing its lines as not to interfere with or impede the public in its use of the streets or render them dangerous to public travel, and maintaining them in a safe condition. In New York the court enjoined the company from erecting a pole in front of plaintiff's place of business, which created a hindrance to free access to the store.

The company is bound to use the utmost care in the maintenance of its wires, and if a wire falls or breaks, the company is liable for any injury caused thereby, unless it be some latent defect, which by the exercise of reasonable care it could not detect. If a storm of unusual and extraordinary severity causes a wire to fall and it is permitted to remain an unreasonable time the company is liable for injury caused thereby, otherwise not. If the company permits a live wire to remain exposed for a long time, it is liable, or if it permits it to remain after notice has been given, it is liable. Most of the cases coming under this rule are where telephone wires have broken and fallen across high-tension electric wires.

The relation of the company to employés for personal injuries is largely one of fact, but the general principles are better defined. It is the duty of an electrical company to use reasonable care, to furnish its employés with safety appliances and to keep the same in reasonable repair, and this duty can not be delegated so as to relieve the company. Reasonable care and prudence is a relative term and depends on the facts in each case.

One who chooses to enter the employment of an electrical company assumes the risks incident to the employment, and which he has no reason to expect to be counteracted or removed. The company is not compelled to furnish printed rules. If the employé chooses the more hazardous of two methods he does so at his own risk.

The courts are not in harmony as to the liability for accidents due to electricity, and a different rule governs for high-tension and low-tension currents. The true rule seems to be that the degree of care changes with changing circumstances, and must be in proportion to the danger.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A New Mineral Industry.

A description is given here by Jacques Boyer of a new industry, that of extracting radioactive minerals from their ores, which has been established at Nogent-sur-Marne, France, by A. de Lisle. This industry bears little resemblance to ordinary chemical works, as whole carloads of minerals are treated for an ultimate product consisting of a few minute particles of radium salts, the value of which, in the pure bromide, is about $36,000,000 a pound. Radium has not yet been isolated in the metallic state; it exists only in the form of salts possessed of a greater or less degree of activity. These are prepared by a series of manipulation known by the name of "gross treatments" during which the radium salts are extracted in a greater or less degree of purity by chemical action. This is followed by fractionatings accomplished through successive crystallizations, during which the more active salts are separated from those less active. The "gross treatment" produces a material with an activity from fifty to sixty times that of uranium. The last fractionatings produce a salt two million times as active as uranium. Various sources of radium are treated at these works, the principal ones being pitchblende, autunite, chalcolite and thorianite. The metals are first finely pulverized at ball-mills, crushers, or stamp-mills, and are then treated in wooden vats. The residues from uranium minerals contain sulphates of almost all the metals. As the sulphate of radium is the least soluble, the object is to wash out all others, so that the materials are subjected to a series of washings and attacks, sometimes with acids, sometimes with alkaline solutions, and sometimes with water. To treat one ton of residue requires five tons of chemicals and fifty tons of wash water. These processes give a product with an activity of about fifty. This is then subjected to repeated crystallization carried on in parallel lines, the crystals, in all cases, containing the more radioactive material. The first fractionating separates the material into crystals and liquor. The crystals are redissolved and recrystallized, while the liquor is evaporated until further crystallization takes place. The crystals from the latter solution are then added to the liquor from the more active part and in this way, by repeated treatment, the materials for the market are secured. During these tests, it is necessary to watch carefully the work and to make frequent chemical as well as physical tests of the product. At the same factory, other substances are also radio-energized, which is done by condensing the radio-emanation, by means of liquid air, on the materials, which are then sealed up in a glass tube until required. This treatment is used for a number of medicines.—*Abstracted from the Engineering Magazine (New York), November.*

The Telephone Cable in Lake Constance.

A description is given here of the laying of a Pupin telephone cable in Lake Constance, which was done during the present year by Siemans & Halske. There are a number of cables of the ordinary submarine type used now for telephone purposes, connecting England with points on the Continent or laid across the Baltic Sea. All these cables are insulated with gutta-percha and laid in comparatively quiet water. The new cable was laid really as an experiment, as the distance between Friedrichshafen and Romanshorn is only seven and one-half miles, and these points are already connected by a cable of the usual type. In the new cable gutta-percha is not used for insulating the conductors on account of its high specific inductive capacity. The material which is used to reduce the capacity of the cable is hydroscopic, such as paper, and must, therefore, be protected from moisture. Such protection can be secured by covering the paper-insulated conductors with a lead sheath, but the lead is not strong enough to withstand the hydrostatic pressure existing at the bottom of Lake Constance. The maximum depth of this body of water is about 800 feet, so that some construction was necessary to enable the lead covering to withstand the pressure. To devise a suitable method a number of pressure tests were made with various lead sheaths, all of which collapsed. It was found, however, that when a steel winding was placed within the lead, sufficient rigidity was obtained to withstand a pressure of 150 atmospheres, which is six times that existing at the bottom of the lake. The cable itself consists of seven circuits, or fourteen copper wires, insulated with paper, laid together and covered with a further layer of insulation, over which is laid the inner steel winding. Next comes the lead sheathing and over this the ordinary coverings and armorings required for the different sections of the cable. For the deep-sea section but one armoring sufficed. At the shore two layers of armor were necessary. The land sections of the cable are covered with lead without the inner steel stiffening, this, of course, not being necessary. The cable was made up in sections 1,500 feet long and the Pupin coils were inserted between the successive sections, alternately four coils and three coils, so that each circuit has a coil every 3,000 feet. The ordinary cable sections were laid up by machine as usual. At the ends the paper insulation was omitted and gutta-percha substituted. This was to secure a water-tight joint of the cable should the sheathing of a coil give way. The sections containing the coils were laid up by hand, and also covered with lead and armored. Before laying the main cable, an experimental test was made, during which a short section of cable, containing a number of coils, was laid in various places. For laying the cable the machinery was mounted on a barge used for ferrying vehicles. This was towed by a tug and performed the work satisfactorily. After the test an attempt to lay the main cable was made on August 9. After a short section was down the cable showed a fault. Upon drawing it in it was found that the sheathing at one of the first coils had been punctured. This fault was repaired, and the work was started again on August 10 and proceeded at the rate of three and one-half miles an hour, the entire work being completed in two hours. The shore ends were connected and the cables found to work with entire satisfaction.—*Translated and abstracted from Electro (Brussels), September.*

The Sparking-Coil Condenser.

An account is given here of certain experiments conducted to determine the most suitable place for placing a condenser used with the ordinary induction coil.

It is usually said that the function of this condenser is to take care of the extra current, but if this is the case, why are not as good results obtained when the condenser is connected across the primary winding as when it is placed directly across the interrupter? The coil used was a two-inch spark-coil with plain trembler interrupter. The efficiency of any arrangement was judged by the maximum distance the secondary spark would jump continually. It was found with any resistance in circuit, except that of the coil itself, it was better to have the condenser across the interrupter than across the primary. On reducing the resistance of the circuit until the coil was carefully connected with short leads to two big accumulators, it was found that either position of the condenser gave practically the same results. By inserting a resistance between the battery and the interrupter, a better spark is obtained with the condenser across the interrupter than across the interrupter and resistance. If a second resistance be connected in the condenser circuit, the spark is still weaker. This, it is thought, shows that the function of the condenser is not merely to take care of the so-called "extra current." The action seems to be the maintaining of a zero potential across the interrupter at the time of breaking. This can only be done when there is no resistance in the condenser circuit or between the condenser and the interrupter. Oscillograph curves were taken with the condenser in various positions. These show that with it in circuit the decrease in primary current is much more rapid than without it, but the condenser does not affect the current at "make" to any extent. With the ordinary condenser, there was no tendency to set up oscillations in a circuit, but when a larger one was added, oscillations were set up, although these died out before the subsequent spark jumped.—*Abstracted from the Electrical Review* (*London*), *October* 18.

The Permeability of Alloyed Irons at High Flux Densities.

A discussion of a series of tests conducted by E. A. Watson to determine the permeability of certain of the new alloys of iron is given here by the experimenter. The tests were made to determine the value of the new alloys for use in generators, the object being to see whether the decreased hysteresis loss compensated for the lower permeability of the material as compared with ordinary steel. As the tests were all to be carried out at high flux densities, a special apparatus was designed for this purpose, which consisted of a U-shaped iron frame of high permeability, on which were placed the exciting coils. The ends of this core were prepared to receive the samples of the materials to be tested. These were stamped strips placed side by side without any insulation between, and with the edges filed smooth so as to make good magnetic contact with the ends of the iron core. Test coils were placed in various positions on the sample to determine to what extent leakage affected the result. The leakage was reduced by placing side pieces spaced somewhat from the test piece and not surrounded by the test coils. It was found that this practically avoided all error due to leakage. Moreover, it was decided that the errors due to the reluctance of the magnet core and the air-gaps were negligible, due to the precautions already mentioned. Various samples, both of transformer iron and of the alloys, were tested, the former being intended as a check on the measurements of the other. The measurements were made ballistically, and care was taken to avoid errors due to the previous state of the iron. The curves showed that the ordinary transformer iron was more permeable than the alloyed irons, though the difference was not very great. It is probable that the permeability of this particular iron was not as high as that of sheets used for armature construction, as it was not intended for use at high flux densities. It was found, also, that the allowed irons differed considerably among themselves. In fact, the permeability curve of one sample crossed that of two others. The results show that it is not possible to exceed about 24,000 or 25,000 lines per square centimetre of apparent density, the true density being about twenty-five per cent greater than this. To reach this density with the alloyed iron, a higher excitation is required than for the ordinary iron. It was suggested that in direct-current machines, where the air-gap is greater than that necessary for mechanical clearance, the latter might be reduced and the saving here used for forcing the flux through the iron itself. This, it is said, would be better than a wide air-gap, since the permeability of the iron is not constant. The use of the alloys would effect a considerable saving in hysteresis losses.—*Abstracted from the Electrician* (*London*), *October* 18.

Metallic-Filament Lamps.

A brief description is given here of a method of manufacturing metal filaments for incandescent electric lamps, which has just been patented by the British Thomson-Houston Company. The invention relates to non-ductile filaments of a refractory metal, such as tungsten or molybdenum, made from plastic threads, and containing the metal, or a compound, and a binder, which are mounted for subsequent treatment upon the supports for the finished filaments. Each support consists of a glass stem carrying nickel wires arranged in pairs, to avoid sharp bends in the filaments. The filaments are looped over these wires and the lower ends of the loop again looped over a lower set of hooks. The latter looping may be omitted if desired. In another construction the glass arms are replaced by a bulbous support to which the nickel wire hooks are attached, as before, in pairs. In preparing the tungsten filaments, a paste of the metal and glucose, with oxides if desired, may be used. The threads are dried by heating in a resistance furnace to about 250 degrees centigrade. They are then carbonized in a second heater at about 350 degrees, after which each support is placed in a bulb, which is then exhausted, and the filaments heated by a current to reduce the oxides and drive off part of the carbon. The remaining carbon is removed by heating in an oxidizing atmosphere, and then the filaments are heated in a reducing atmosphere, leaving it in the metallic state.—*Abstracted from the Electrical Engineer* (*London*), *October* 18.

Illuminating Engineering Society.

The New York section of the Illuminating Engineering Society will hold a meeting at the Engineering Societies Building, 29 West Thirty-ninth street, New York city, on Thursday evening, November 14. A paper will be presented by W. S. Andrews, of Schenectady, N. Y., entitled "Pioneer Electric Lighting." This lecture will treat of the early development of the incandescent electric lamp and central station practice.

Electric Power for Sao Paulo, Brazil.

The Brazilian government has accepted the bid of Guinle & Company, of New York city, to furnish electric power in Sao Paulo, Brazil. The electric current will at first be used for operating the public waterworks system, and later for lighting purposes.

Ernst Danielson.

By the death of Ernst Danielson, the Swedish engineers have lost one of their most prominent members. Although he had scarcely attained middle age, Danielson had done more to further engineering knowledge than is generally possible for a man during a long life. Modern electrotechnical science has lost one of its pioneers, as his name was well known and his work appreciated far beyond the frontiers of Sweden and of Europe.

Danielson was born on January 19, 1866, in Voxna, and after having studied at Upsala he was, in 1883, admitted as apprentice at the Arboga works of the Stockholm Electrical Company. In 1884 he entered the Technical High School in Stockholm, where he passed his final examinations in 1887, and from there returned to the Arboga works. During 1888 he experimented in Norrkoping with a method of electrical tanning, and after these experiments were concluded he was appointed assistant engineer to the electrical company, where he stayed until 1890, when he went to the United States. There he first accepted a position with the Wenström Consolidated Dynamo and Motor Company, of Baltimore, and afterward with the Thomson-Houston Company, of Lynn, Massachusetts, which a short time later was consolidated with the Edison Company of Schenectady, forming the present General Electric Company of America. While with the Thomson-Houston Company, Danielson carried out a large amount of exceedingly responsible work. In 1892 Danielson was offered the position of chief engineer, by the Allmanna Svenska Elektriska Aktiebolaget, of Westeras, Sweden. Before entering upon the duties of this position, he, during the summer of 1892, visited works in England, France, Switzerland and Germany. In April, 1895, Danielson left the Swedish company in order to enter upon a consulting engineering practice in Stockholm. Here, among other important undertakings, he prepared, at the request of Dr. de Laval, proposals for utilizing the water power of the Trollhättan Falls. During the winter of 1897-8, Danielson again visited America, and on his return visited most of the prominent electrical installations in Switzerland and Italy. In 1900 he was appointed to the position of technical director of the Allmanna Svenska Elektriska Aktiebolaget, and occupied this position until 1903, when it became necessary, owing to his failing health, to delegate most of his work to others. The last years of his life were spent partly in the country, and the last two winters in Teneriffe and Mentone, where it was hoped that he would benefit from the mild climate.

While living in Stockholm, Danielson was for some time chairman of the Swedish Institution of Civil Engineers (Svenska Teknologföringer). In 1906 he was elected a member of the Royal Academy of Science; he was also a member of the Institution of Electrical Engineers of Great Britain, and of the American Institute of Electrical Engineers.

Danielson's most important pioneer work consists of his researches in the three-phase system, and its utilization for power transmissions. Having studied Wenström's inventions—which at that time, however, had not been put into practical shape—Danielson, as already stated, went to the United States. During his two years' stay in America he had exceptional opportunities for making exhaustive practical tests with the three-phase system, and at this early date he became convinced of its practical importance. At this time (1890) only very meagre results had been achieved in Sweden with the Wenström three-phase system. On his return from America, Danielson devoted considerable attention to the design and development of lines of thoroughly satisfactory three-phase apparatus. After a comparatively short period, during which time he had worked extremely hard, the first machines were completed and were found to realize fully all expectations. On the basis of experiments with these machines, the theory was now still further developed, and in this connection, Danielson drew up his plans for the use of the three-phase system for electric power transmission on a considerable scale. The first work to be carried out was the well-known Hellsjön-Grängesberg power transmission, the success of which led to several other power schemes, such as Hofors, Boxholm, etc.

Ernst Danielson.

During 1892 and 1893, when he was planning these installations and designing the machinery to be employed, theories for this type of machine were not altogether wanting in foreign countries. These theories had received, however, but little practical confirmation, and Danielson's installations were in reality pioneering work, when due regard is paid to the size of the whole installations as well as of the individual machines, and above all to the good results which were obtained. It is probably a rare occurrence that installations so novel in all details, and carried out on such a large scale as those above mentioned, should work in such a satisfactory manner from the very start, and the fact that, after the lapse of twelve to fourteen years which have been characterized by enormous developments in electrical science, these pioneer installations of Danielson's are still working, bears striking testimony to his engineering judgment and ability.

Danielson's electrical researches did not end with the three-phase system and its developments. On account of his position and of his interest in all branches of science, he had opportunities to devote himself to other branches of electrical development, in which he accomplished valuable theoretical and practical work. During recent years he devoted himself mainly to the development of the theory of the single-phase motor, and the investigations which he published constitute very important contributions to progress in single-phase motors.

Though his main work relates to electrotechnical science, Danielson was thoroughly at home in several other branches of engineering science, and took a considerable interest in the utilization of electricity in other technical branches. As an instance may be mentioned that, with his considerable knowledge of turbines and machinery for the utilization of water power, it was possible for him clearly to realize the features which are necessary for hydroelectrical installations, and his knowledge of rolling-mill and of mining machinery enabled him to appreciate the requirements to be met by electric motors for this kind of work. It is largely on account of this many-sidedness in technical knowledge, during a time when the electrical science was rapidly developing, that Danielson's work has been of such great value. Those who knew him personally will always remember him as a kind and true friend.—*Teknisk Tidskrift, August* 24, 1907.

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

The Allegheny County Light Company's Plans and Methods of Cultivating New Business.

Pittsburg is located, as is well known, in the natural gas belt of Pennsylvania, and gas at thirty cents per thousand cubic feet, for private consumption, is one of the obstacles in the way of the more general use of electricity which the Allegheny County Light Company has to contend with. In fact, until very recently, the price of natural gas was only twenty-five cents per thousand cubic feet. For manufacturing purposes it costs considerably less and furnishes most favorable conditions for the operation of small, competitive and isolated gas-driven plants.

The business-securing department of the Allegheny County Light Company consisted, a few years ago, of a general contracting agent, one record clerk and one stenographer. The fact that the company now employs twenty-eight men in its business-securing department, in addition to eight in its clerical department, speaks for itself, and it believes that the additional expense, etc., is fully justified by the business that has been secured and its character.

R. S. Orr, the general superintendent, is a broad-gauged business man in the truest sense, and the record and growth of this great company under his guidance has been one of which it may well be proud.

Mr. Orr is ably seconded in the commercial branch of his duties, by his general contracting agent, Wm. A. Donkin,

WILLIAM A. DONKIN,
General Contracting Agent.

a portrait of whom is published in connection with this article.

The Allegheny County Light Company's soliciting department at present consists of a general contracting agent, assistant general contracting agent, two expert power solicitors, one illuminating engineer, one expert sign solicitor, one solicitor whose time is devoted exclusively to municipal business, and twenty-two general solicitors.

A VALUABLE POWER-BUSINESS WRINKLE.

The company's chief obstacle in securing power business (particularly large installations) has been due, until lately, to inability to promptly replace defective gas and steam equipment with electric motor equipment of the proper capacity. It has, however, overcome this by carrying in stock a various assortment of motors ranging as high as from seventy-five to one hundred horse-power. These motors in addition to aiding in securing permanent business and being purchased outright by customers, have more than warranted the investment by the rentals obtained for them from emergency and temporary installations. To central stations contemplating making an active bid for power business, the Allegheny County Light Company strongly recommends the carrying of a stock of various sizes of motors, depending upon the requirements of the particular location.

In connection with this it is interesting to note that the power load has increased 3,159 horse-power during the past year, and, better still, most of this increase strikes the off-peak period. In view of this the company can, of course, make better rates, and, in many instances a clause is introduced in the customer's contract which stipulates that this service shall not be used during peak-load hours.

JOSEPH MCKINLEY,
Manager Power Department.

FREDERICK F. KELLOGG,
Assistant General Contracting Agent.

ROBERT A. WESTFALL,
Who Looks After Municipal Business.

FIRM BELIEVERS IN PUBLICITY.

This company's officials are firm believers in publicity, and have found the advertising matter which they receive regularly from several advertising companies for distribution among their prospective lighting and power customers a valuable aid. It not only constantly keeps the company before this latter class of

business, but has in many cases paved the way for the solicitor and gained him an interview which usually results in the closing of contracts. It also keeps the company's service before possible consumers, so that, in case of a breakdown, they know where to turn for the quickest relief, and the service, once installed, usually becomes a permanent fixture.

The spicy, up-to-date arguments presented in this advertising matter keep the company's service well in the mind of prospective power users, and the inquiry (which is sure to result, sooner or later), in response to this clever and persistent advertising is followed up by aggressive work on the part of the soliciting force which has resulted in placing the power load on a very profitabe footing.

Where the company has had to contend with an obstinate customer, one who would not see the advantage of central station service—it has often gone so far

DREW JOHNSON,
Manager Electric Sign Service.

as to install and lend him motor equipment on thirty days' trial, charging only for the current used. This has invariably resulted in the company securing a long-term contract, in addition to the customer purchasing the equipment. This feature, in itself, has developed considerable business. Only recently the company in one day closed contracts involving a total of 575 horse-power.

It has also been found advantageous to extend and operate special two-phase and three-phase power-circuits to supply the larger installations, so as to insure a continuity of service and not interfere with lighting circuits.

COMMERCIAL LIGHTING.

Commercial lighting business has shown considerable improvement, principally due to encouraging window and show lighting. Many long-hour burners have been secured by the judicious arrangement of interior lighting in connection with which method the services of an illuminating engineer have been found invaluable.

Photograph of the Allegheny County Light Company's Business-Getters, taken October 31, after a month's work, during which time 772 contracts were secured, involving 21,631 incandescent lamps, 284 Nernst lamps, 1,073 horse-power in motors, 139 commercial arcs, sixty-one municipal arcs, and forty-nine 50-candle-power incandescent street lamps

In many instances where long-hour burners had used gas through the day and either combination gas and electric, or wholly electric illumination during the evening and business hours, which necessarily came on the peak-load, the rearrangement of his lights and the introduction of high-efficiency lamps has often enabled him to keep his bills well within his lighting appropriation and secure more efficient service by the use of electric light, which has led him to discontinue the use of gas and employ electric lighting exclusively.

The introduction of electric illuminated signs, in addition to proving a satisfactory venture, has had an educational effect and invariably led to the consumption of larger quantities of current.

Let us run your business for you——
Let Us Run Your Business
The Allegheny County Light Co.
CONTRACT DEPARTMENT
Tel. 3200 Grant. 435 Sixth Ave.,
Pittsburg, Pa.

An attractive and curiosity-compelling folder, forming a part of the direct-by-mail power campaign of the Allegheny County Light Company.

The company's greatest endeavor has

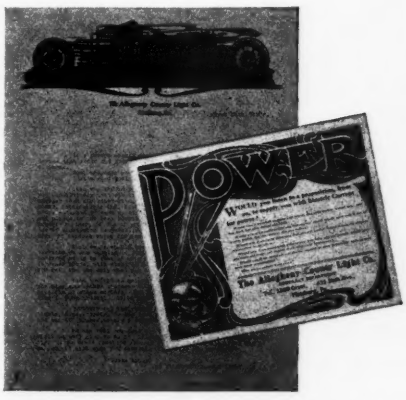
been to please the customer. It has been found that, once his confidence has been gained, he is always ready to consider and grasp the advantages to be derived from any novel feature tending to be productive of more business which the

Theatre programme advertisements used by the Allegheny County Light Company.

company might introduce—all of which, of course, will tend to a larger consumption of electric current.

THE DISPLAY AND EXHIBIT ROOM.

The exhibit room is considered a necessary adjunct to the company's regular office. While the direct sales of apparatus do not aggregate much, inquiry among the local supply houses has disclosed the fact that their sales of electrical heating and cooking apparatus have shown an enormous increase, which directly benefits the company, as this apparatus is necessarily used on its lines. Friendly relations are maintained as much as possible, with these local supply houses, and the sale and use of this small apparatus is encouraged. Where the customer has been unable to secure prices and information relative to some special apparatus from local dealers, the company undertakes to secure such information for him.



A mailing card and typewritten letter which formed part of the Allegheny County Light Company's advertising scheme for power business.

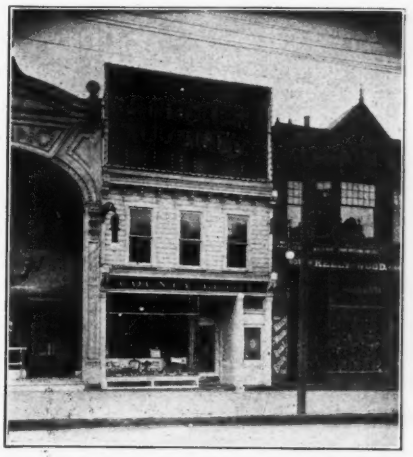
The company's booth at the exposition of the Western Pennsylvania Exposition Society, which recently closed, was a centre of interest not only to local people, but people from adjacent towns. A motor-driven washing machine, a motor-driven coffee mill, a motor-driven sewing machine, a large assortment of cooking and heating utensils, and also the different styles of electric lamps, were exhibited.

The number of inquiries which have been received as to "whether electric irons were meant for heating on a gas range (!)" and as to the methods of operating other apparatus only tends to demonstrate that the public, in general, is not conversant with the practical modern applications to which electric service can be put, and in a great many instances surprise has been expressed that electricity could be used for any purpose other than incandescent lamp lighting.

While there is no way of arriving at any definite estimate as to the benefit derived from such an exhibit the Allegheny County Light Company feels that, in addition to the advertising, the demonstrating to the public of the various small cooking and heating utensils that can be put out at a very nominal operating cost (particularly those that are used at the table during meals, the operating expense of which, as compared with alcohol as fuel, is much smaller) will, in the near future, through the increased current consumption due to the use of such apparatus, more than reimburse the company for the expense to which it has gone to make its exhibit a success.

RESIDENTIAL BUSINESS.

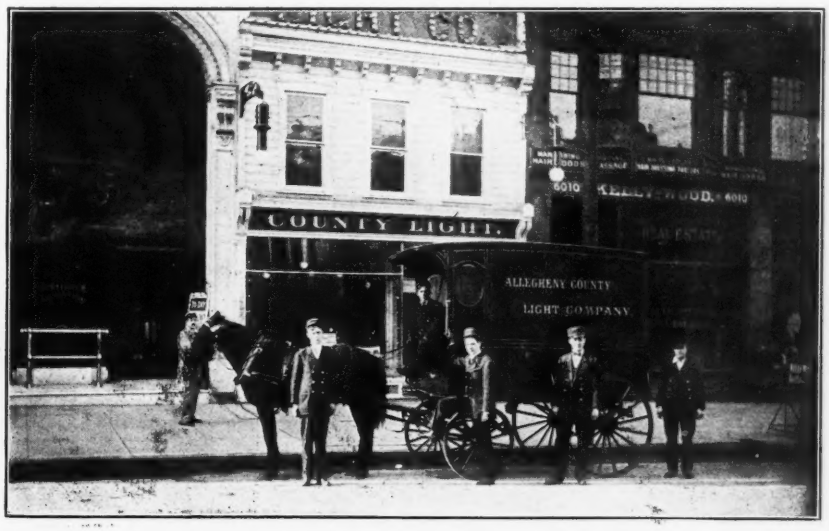
Residential business has not been neglected. While widely scattered and not as productive as the more centralized commercial business it, however, offers a very productive and always increasing field.



East End branch office, Allegheny County Light Company, Pittsburg, Pa.

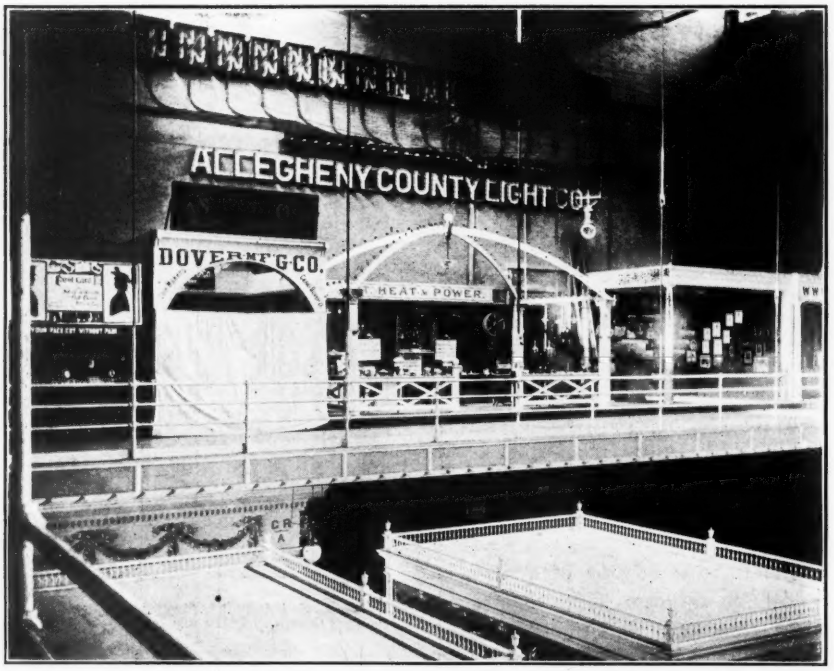
The introduction of electric irons and cooking apparatus has not only been productive of an increased load, but, in many instances, the introduction of an electric iron or some such apparatus has led to the securing of a contract and the installing of the service which, otherwise, would have been impossible.

The placing of irons on thirty days' free trial has resulted very satisfactorily. Out of 1,100 irons placed since July 1, 1907, approximately 900 have been retained and paid for. The average current consumption of these irons is from 450 to 500



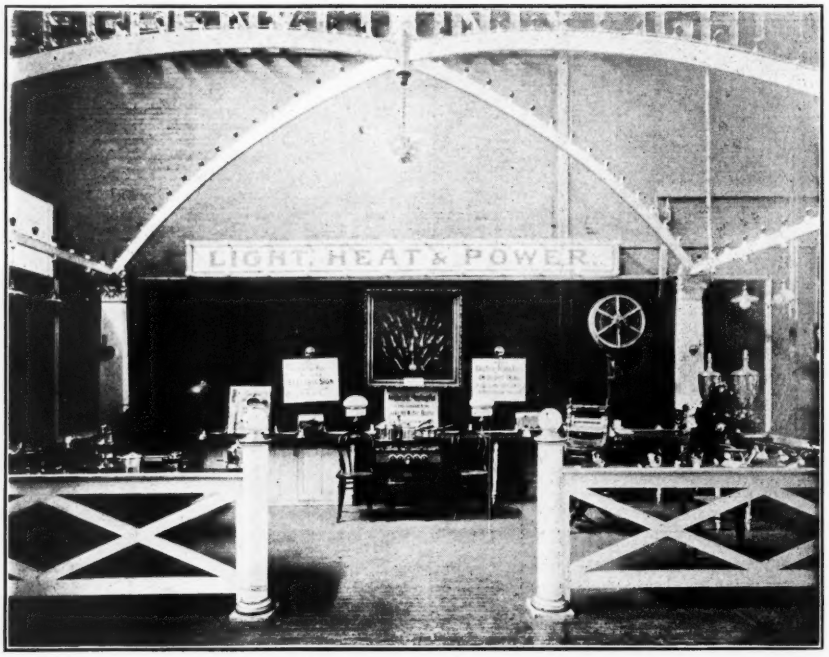
Lamp-Renewal Wagon and East End branch office, at 6,012 Penn Avenue, Pittsburg, Pa., of the Allegheny County Light Company.

watts, or approximately, five cents per hour. It is figured that for the average family, this shows an increase in the monthly bill of approximately $1.50. The revenue from this source alone is not to be overlooked, and the introduction of an iron invariably leads to the use of other electrical apparatus in addition to encouraging the customer to a freer use of electric current in general.



Booth of the Allegheny County Light Company at the 1907 exhibit of the Western Pennsylvania Exposition Society, Pittsburg, Pa.

One of the greatest obstacles that has been encountered has been the lack of familiarity on the part of the customer as to the simplicity of the operation of central-station service when once installed. The ice broken, however, and friendly relations once established, no difficulty has been found in impressing upon prospective customers that the convenience, simplicity, cleanliness and flexibility of central-station service is not a luxury, but a necessity to him in his business as well as domestic life.



Booth of the Allegheny County Light Company at the 1907 exhibit of the Western Pennsylvania Exposition Society, Pittsburg, Pa.

These aggressive commercial methods, backed by efficient service on the part of the operating department, together with a frank and open policy, have proven very successful in the case of the Allegheny County Light Company, and certainly such a policy should commend itself to many other central-station officials.

Take a man into your confidence and explain the why and wherefore instead of letting him wonder what is wrong! Not knowing the causes of the troubles in service which are bound to arise from time to time, and not knowing their remedies, he is apt to become disgruntled. The smallest disturbance, such as the blowing of a fuse, appears to him as a breach of faith on the part of the company and sufficient cause to justify him in breaking his contract. If, however, the customer had been properly enlightened at the start, the fuse could have been replaced in a few moments and no inconvenience caused by the interruption of the service and resultant loss of business.

If properly followed the up-to-date and liberal policies of the Allegheny County Light Company will not only put central stations on a better footing in the community in which they operate, but will lead to the securing of profitable new business.

New York Electrical Society.

At the 270th meeting of the New York Electrical Society, October 30th, Mr. E. G. Acheson lectured on "A New Departure in Lubrication," describing the evolution of the new lubricant, deflocculated graphite, and indicated the radical modification it seems likely to effect in lubrication uses throughout the world.

The following members were elected: Wm. G. Davies, Jean C. E. Ohlenslager, William Griebe, C. H. Hungerford, Joseph A. Shaw, Charles Dunn, Charles D. Maxfield, James McNamara, John C. Terry, Baxter Reynolds, J. Geo. Payne, Wm. J. Mundell, John D. Gilbert, Jr., L. A. Hazeltine, William Schultz.

Civil Service Examinations for New York State and County Service.

The State Civil Service Commission will hold examinations on November 30 for the following positions: assistant civil engineer, state engineer's department, $5 to $6 a day; axeman, $2 a day; electrical engineer, Public Service Commissions, $1,500 to $3,600; gas engineer, Public Service Commissions, $1,500 to $3,600.

The last day for filing applications for these positions is November 23. Full information, with application blanks, may be obtained, upon request, from Charles S. Fowler, chief examiner, Albany, N. Y.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The De Laval Clarifier and Filter.

The accompanying illustrations show a clarifier and filter placed on the market by the De Laval Separator Company, 74 Cortlandt street, New York city. The De Laval clarifier and filter is a direct result of the work of Dr. Gustaf De Laval, of Stockholm, Sweden, who invented the De Laval cream separator in 1879. During the past twenty-eight years, while bringing the De Laval separator to its present state of perfection, the De Laval company has made a constant study of centrifugal force and the uses to which it may be applied. While the fundamental principles and wearing parts of the De Laval clarifier and filter are the same as those of the De Laval cream separator, the two machines

FIG. 1.—DE LAVAL CLARIFIER AND FILTER, STEAM TURBINE DRIVEN TYPE.

differ greatly in detail construction, and the De Laval clarifier and filter is constructed especially for clarifying and filtering varnish, japans, lacquers, patent medicines, wines, spirits, liquors, writing ink and other products containing either a sediment deposit or the finest flock.

Fig. 1 shows the steam turbine style of clarifier and filter for direct steam connection. Fig. 2 shows a sectional view of that part of the De Laval machine in which the clarifying and filtering is actually accomplished. This is called the bowl, and consists of two separate compartments, which, since their duties are quite different, really perform the work of two independent machines.

The first or lower compartment is the clarifying chamber, the upper the filtering chamber. The clarifying chamber consists of a cylinder filled with a series of conical-shaped, pressed steel discs, one above the other, about one-sixteenth of an inch apart, and held rigidly in position by a central feeding device called the "split-wing tubular shaft." The filtering chamber or upper compartment is also cylindrical in chape, but of less diameter than the clarifying chamber. Its side wall contains numerous perforations and is lined with filter material H, which may be paper, cloth, wool, etc., governed by the requirements of each product handled. Within this chamber are placed three concentric cylinders dividing the chamber into four compartments G, F, E and D. All three cylinders contain numerous perforations and are lined with filter material H. The liquid first enters the bowl at the point A through the feeding device in the centre and drops to the bottom of the clarifying chamber, and is then forced upwards by the great centrifugal force out through the wings of the tubular shaft into the spaces between the discs, which act as so many independent bowls.

In this operation, from ninety to ninety-five per cent of the coarser dirt and sediment is removed and retained in the sediment pockets B and C. After leaving the discs the liquid continues to be forced upward out of the clarifying chamber into the compartment D of the filtering chamber. Here the same centrifugal force drives the liquid through the walls of the three inner cylinders into compartments E, F and G, the filter material H with which these cylinders are lined catching and retaining all the remaining sediment and dirt not removed by the clarifying compartment.

Lastly the liquid is forced through the filter material lining H of the side wall of the filtering compartment itself, and is then delivered into such receptacle as may be waiting for it. This second operation, which consists of forcing the liquid through four independent linings or layers of filter material H, as may be readily understood, completely removes every last bit of cloud or flock and delivers a thoroughly marketable product.

The construction of this apparatus is simple and substantial throughout. The machine is made in two styles—the steam turbine and the belt power. The steam

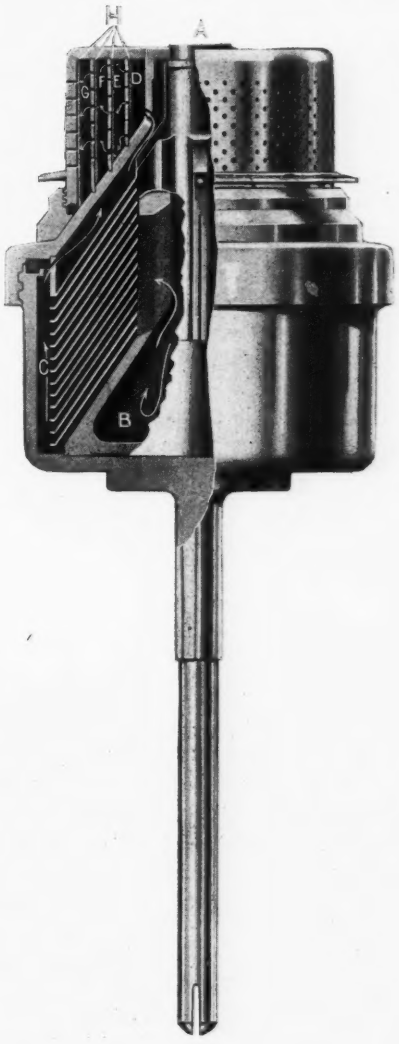


FIG. 2.—BOWL OF THE DE LAVAL CLARIFIER AND FILTER.

turbine style is forty-eight inches high, and has a base eighteen inches by twenty-four inches. The belt-driven machine has the same dimensions, but uses an added floor space of two feet by nine feet on account of intermediate jack and belt.

Electrical Equipment for a Gold Mine.

The Lluvia de Oro Gold Mining Company has purchased, through L. L. Nunn, of Provo, Utah, the machinery for a complete power plant to be operated in connection with its mines in the Sierra Madre Mountains, near El Fuerte, Mexico. It is to consist of a 500-kilowatt Allis-Chalmers steam turbine, running at 3,600 revolutions per minute, direct-connected to one of the same company's alternating-current generators, especially designed for operation with it, at sixty cycles, three-phase and 600 volts. Excitation at 120 volts will be obtained from two small exciter sets, each of fifteen-kilowatt' capacity, one driven by a high-speed engine and the other by an Allis-Chalmers induction motor.

There has also been built by Allis-Chalmers Company, to be installed with the turbo-generator unit, a Tomlinson type "B" barometric condenser, with thirty-six-inch head, and an eight by sixteen by twenty-inch dry-vacuum pump. The water for the condensing system will be brought by gravity to a cold well near the condenser at a height to be forced into the condenser by atmospheric pressure.

The complete equipment, which was shipped soon after the placing of the order, will be installed in a substantially constructed stone power-house. The fact that the plant has been designed by Mr. Nunn, who is one of the best-known constructing and consulting engineers in the country, insures its being a model one in every respect.

As all of this apparatus will have to be carried along a difficult road over the mountains, after being taken by boat from Guaymas to Topolodampo, and thence by rail a part of the distance, the transportation of it will be quite a problem.

The circumstances connected with the discovery of gold in the Lluvia de Oro district, where this turbine is to be operated, are of more than ordinary interest. It seems, according to a correspondent of the *Mining and Scientific Press,* that the existence of valuable ore in the neighborhood had been known through the fact that Indians from that vicinity had for for a long time brought in rich pieces of gold quartz to sell and trade at the stores; but, conformable to the Indian character, they had resolutely declined to reveal the locality from which the specimens were derived. Knowing the facts, a Mexican merchant, named Bernardo Garcia, established a small supply store in the village of Realito, which he supposed to be not far from the mine, it turning out afterward to be about six miles distant.

With the ostensible object of trading with the Indians and travelers between Batopilas and El Fuerte, but with the secret purpose of arriving at the knowledge of the Indian treasure house, Senor Garcia plodded along at Realito for several years, following up clue after clue, but without avail, until he took into his employ an individual named Espiridion, who joined native cunning with an intimate knowledge of the Indian character. Stimulated by the promise of reward, Espiridion wormed his way into the confidence of the Indians. While it is hardly probable that Espiridion had any clear plan outlined in the method of his search, the fact remains that he persisted in cultivating the Indians, trusting, no doubt, to some chance accident to reveal the whereabouts of the coveted mine. Chance at last favored him and Espiridion caught a few words which gave him a clue to the location of the mine. A certain gulch was spoken of, and a few days afterward Espiridion took occasion to wander that way. Arriving near the head of the gulch, he found pieces of quartz containing visible gold. By following this he was led to the base of a limestone cliff, and cropping out of its face stood the quartz body that has dispensed its treasure of gold to the Indians, and which has since become famous as the Lluvia de Oro mine. Discovered and located in 1900 by Garcia, it was bought two years later by the present company for $1,750,000. Garcia named the mine Lluvia de Oro, which means "Shower of Gold."

An Interesting Convention Exhibit.

The accompanying illustration shows a view of the very interesting exhibit made by the Franklin Electric Manufacturing Company and the Holophane Company at the recent Atlantic City exhibition of the American Street and Interurban Railway Manufacturers' Association. The Franklin Electric Manufacturing Company gave a very practical demonstration of its "Novi" lamp, a number of which were mounted on an oscillating machine, showing the comparative stability of these lamps as compared with the ordinary type of anchored filament incandescent lamp. This oscillating machine is well shown on the table at the left of the booth here illustrated. The Holophane Company made a demonstration, the dark room being at the right of the view herewith, showing the effectiveness of the Holophane reflector in connection with the "Novi" lamp for railway car illumination.

EXHIBIT OF THE FRANKLIN ELECTRIC MANUFACTURING COMPANY AND THE HOLOPHANE COMPANY, AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION, APPLIANCE EXHIBITION.

Apple 8-s Switchboard Outfit.

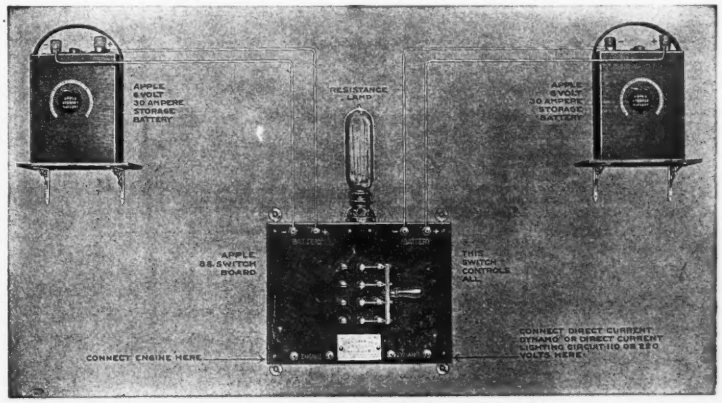
The Apple 8-s switchboard outfit for igniting gas engines, used to drive direct-current lighting or power dynamos, has been developed by the Dayton Electrical Manufacturing Company, Dayton, Ohio, for use whenever direct current (110 or 220 volts) is available:

(1) On stationary gas engines used to drive lighting or power dynamos (direct-connected and belted gas engine-generator sets).

(2) On large marine gas engines with which a lighting dynamo is used.

(3) On gas engines located where a direct-current city lighting or power circuit is available.

The Apple 8-s switchboard provides a means of charging two ignition storage batteries alternately, from any 110-volt or 220-volt direct-current circuit, taken through a lamp of proper resistance, one battery being charged from the lighting or power circuit, while the other is being used for igniting, and *vice versa*.


APPLE 6 VOLT 30 AMPERE STORAGE BATTERY
RESISTANCE LAMP
APPLE 6 VOLT 30 AMPERE STORAGE BATTERY
APPLE 8S SWITCH BOARD
THIS SWITCH CONTROLS ALL
CONNECT ENGINE HERE
CONNECT DIRECT CURRENT DYNAMO OR DIRECT CURRENT LIGHTING CIRCUIT 110 OR 220 VOLTS HERE

ARRANGEMENT OF CONNECTIONS OF APPLE 8-S OUTFIT.

As a 110-volt or 220-volt current is too strong to be used for recharging a low-voltage battery, it is neccssary to take this current through a resistance lamp to reduce it to the proper amount for recharging. The resistance lamp that is used for thus cutting down the current is shown at the top of the 8-s switchboard in the accompanying illustration.

The four-pole, double-throw switch, mounted on the face of the switchboard, severs and makes all connections for transposing the charging and ignition currents from one battery to the other, positively, quickly and without the slightest complication. The entire operation consists simply of throwing the switch handle from one side of the board to the other.

Storage batteries furnish the best current for ignition work, giving off the fat, hot sparks so much desired for igniting the mixture of gas and air in the combustion chamber of the engine. The Apple 8-s switchboard provides a ready and inexpensive means for properly charging ignition storage batteries, thus keeping them at the highest point of efficiency at all times. The switchboard contains a touch spark coil mounted on the back of the board, properly and securely wired.

The switchboard is easily mounted on a post or wall. The wires from both batteries are connected to the binding posts marked "battery," wires from the engine to the terminals marked "engine," and wires from the dynamo to the terminal marked "dynamo." These are all the connections necessary. Any touch or jump-spark coils, timers and plugs of standard make can be used with this outfit.

One of the points in favor of this outfit is that every connection is made correctly and permanently. It is not necessary to move or disconnect the terminals of either battery for recharging.

The use of this outfit lengthens the life of the points in a touch-spark engine. The reason for this is that when the switch handle is thrown on one side of the switchboard, the current for ignition flows through the electrodes in the engine in one direction: and then when the switch handle is thrown on the other side of the switchboard, the current flows in the opposite direction. This distributes the platinum evenly between the two points in the engine, or those in the coil, and gives long life to the points.

Only four pairs of wires are connected to the switchboard, and the wiring is so simple that any one can install the complete outfit in a few minutes.

The switchboard is carefully designed and thoroughly worked out, and is solidly and substantially built of the best materials by workmen skilled in this particular line.

New Steel Switch Conduit Box.

The Marshall Electric Manufacturing Company, Boston, Mass., has brought out a steel switch conduit box drawn in one piece having several novel features. This box is intended for use with flexible conduit. It is provided with eight knock-out holes so that the conduit can be led in either at the end or the bottom of the box. Locking plates are provided where these are desired. The lugs are so arranged that it will take any of the standard switches and plates and the spacing block is shipped with the box so that it can be screwed to lathe if this method of attachment is desired. Holes receiving the switches are drilled with a jig so that their position is absolutely accurate and there is no difficulty in attaching plates and switches. It is claimed by the manufacturers that a good deal of time is saved by the use of these boxes.

The Alexander Miniature Arc Lamp.

The accompanying illustration shows the new domestic arc lamp made by the F. Alexander Electric and Manufacturing Company, 75 Fulton street, New York city. The light given by this lamp is pure white and steady, and all the light is reflected downward in a useful direction.

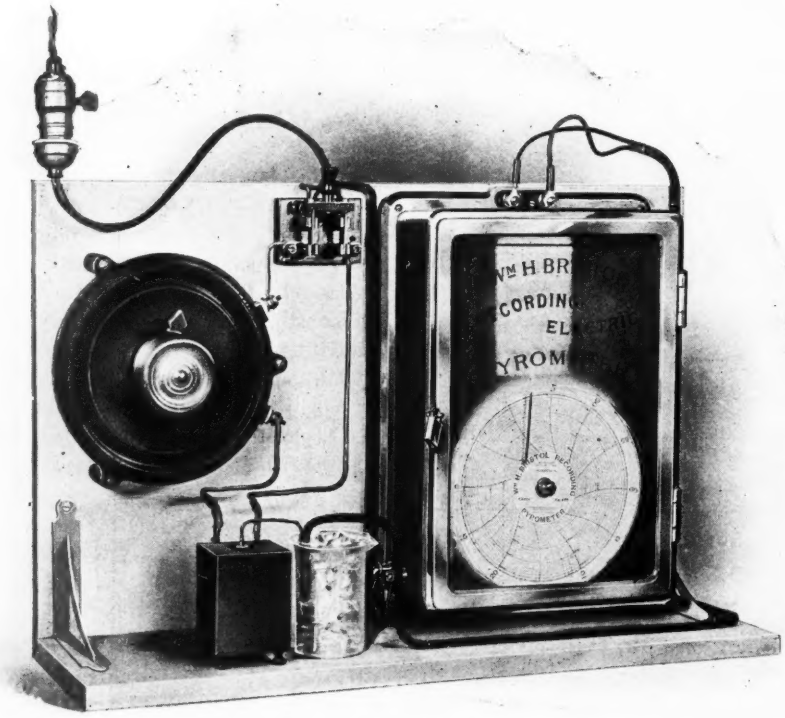
The three-ampere miniature arc lamp gives 500 actual candle-power and consumes 330 watts. The lamp is fifteen inches in length, and can be placed in places with low ceilings and in show windows. The resistance is built in the lamps, giving them a small, neat appearance. The lamp is made for three, four and five amperes, giving, respectively, 500, 700 and 1,000 actual candle-power. These lamps are used in multiple on circuits of 100 to 125 volts for direct current.

THE ALEXANDER MINIATURE ARC LAMP.

A New Electric Laboratory Furnace and Pyrometer Outfit.

A special laboratory unit consisting of an electric furnace and recording pyrometer, with attachments, designed for determining the recalescent points of steels and for hardening small tools, shown in the accompanying illustration, has been developed and placed on the market by William H. Bristol, 45 Vesey street, New York city. The unit is compact, may be mounted upon an office desk or table, and current taken from an ordinary lighting circuit.

The electric furnace itself is of simple construction, its special patented feature



Electric Furnace and Recording Pyrometer Outfit.

being the lining of fused quartz, which makes it possible to turn on the full current suddenly and thus to heat up the furnace quickly without danger of cracking its interior.

The illustration herewith shows the new laboratory unit especially designed for determining the recalescent points of various kinds of steel. The electric furnace is here shown in circuit with a rheostat so that after the full current has been turned on, bringing the furnace up to a bright red heat on the inside almost immediately, the rheostat may be adjusted so as to maintain the desired temperature.

The recording pyrometer is equipped with the patented semi-transparent smoked chart and a special vibrating device which brings the sensitive surface of this chart in contact every half second with the recording arm of a special Weston electrical movement. As friction between the recording arm and the chart is eliminated, an accurate record is obtained directly without the use of relays or other complicated devices. A chart of special graduations covering a range of 2,000 degrees Fahrenheit is furnished with the outfit. In order that very quick variations of temperature may be recorded, this chart is arranged to revolve once in sixty minutes.

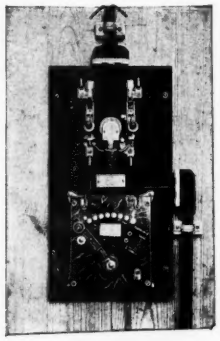
The special design of this laboratory unit makes it very convenient for measuring the recalescent points of steel, or in other words, the temperature at which a molecular transformation occurs, below which the steel can not be hardened. To obtain a record of the recalescent points of a lot of steel, a small sample is selected of cylindrical form about seven-sixteenths-inch diameter and about one and one-half inches long. A hole of one-eighth-inch diameter and three-fourths deep, is drilled into the end of the sample. After the electric furnace has been heated up by turning on the current, this piece of steel is inserted into the top of the furnace and the tip of the thermo-couple is introduced into the hole of the sample. As the steel is gradually heated up by the furnace, the rising temperature inside it will be recorded on the chart. After the temperature has been raised as far as desired, the piece of steel may be withdrawn from the furnace without disturbing the couple, and as the steel cools, its fall in temperature will also be recorded on the chart. The records of these raising and falling temperatures will be shown as curves on the charts on which the recalescent points will be easily discovered.

The "Security" Motor-Starting Panel.

The F. Bissell Company, Toledo, Ohio, has placed on the market a new type of motor-starting unit combining all the safeguards required by the National Electrical Code. This panel has been brought out to meet the demands of the trade for a unit form of efficient, self-contained motor-starting panel.

These switches are made in two types. The automatic circuit-breaker type permits the adjustment of the switch for any load. The panel is also furnished with knife switches and fuses if desired. The switches are furnished with or without rheostat, as the installation may require.

With this switch, if the wires become crossed with a circuit carrying high-tension current, the switch immediately cuts



The "Security" Motor-Starting Panel.

out the circuits which it protects, preventing damage to the apparatus behind it. The switch can be set to operate at a point only a little higher than the regular voltage, so that crosses are instantly detected and removed before the switch will remain closed. The switch opens whether the circuit is in operation or not, and no injury can occur by starting while a cross is on the circuit and has not been detected. It will open on 0.05 of an ampere of foreign current.

Current Electrical News

DOMESTIC AND EXPORT.

MEXICAN ELECTRICAL NOTES—An electric light plant is being installed at Muzquiz, Coahuila, at a cost of $40,000. A company was recently formed for the purpose. Work has been begun on the street-lighting and street-car systems in Vera Cruz, which are being built by the British firm of S. Pearson & Son. H. S. Bolton, who recently equipped the substations of the Compania de Tranvias, Luz y Fuerza, at Guadalajara, is in charge of the work.

TO DEVELOP ALABAMA TOWNS—The organization of the Birmingham & Gulf Railway Navigation Company, with a capital of $10,000,000, has been completed by J. M. Dewberry, president of the Tidewater Development Company. To it have been transferred the franchises and rights of way of the latter corporation, as it will be the operating company. The Tuscaloosa Belt line has been acquired and will at once be electrified. Operations will also begin in Birmingham, and a line of boats and barges will be operated on the Warrior river from Tuscaloosa, Ala., to Mobile. It is the intention to organize light and power companies for Alabama cities and towns.

CONSOLIDATION OF POWER COMPANIES IN SOUTHEASTERN IDAHO—The Idaho Consolidated Power Company, with a capital of $2,000,000, has absorbed the American Falls Power, Light and Water Company, the Pocatello Electric Light and Power Company and the Blackfoot Power and Water Company, formal transfer of these holdings of James H. Brady, of Pocatello, Ida., having been made. Mr. Brady retains the presidency of the consolidation. The plans include the development of 50,000 horse-power at American Falls and the transmission of electrical energy to surrounding towns. Twenty-five hundred horse-power is now being generated at American Falls, and this will be increased to 6,500 within sixty days.

NEW HAVEN ROAD BUYS TROLLEY LINES—Oakleigh Thorne, president of the Trust Company of America, has announced that the New York, New Haven & Hartford Railroad has acquired the controlling interest in the Millbrook company, heretofore held by Mr. Thorne and Marsden J. Perry. This purchase will give the New Haven a new direct electric line from New York city to the Connecticut state line and will enable it to connect its Connecticut trolley lines with New York. Messrs. Thorne and Perry acquired control of the Millbrook company about a year ago. The Millbrook company is the holding company which owns a majority of the capital stock of the New York, Westchester & Boston Railway and the New York & Port Chester Railway. The New York, Westchester & Boston was incorporated in 1872, but from March, 1876, to January, 1904, was in the hands of a receiver. The present interests then acquired control and construction work under the original franchise was begun. About the same time the company acquired the New York & Port Chester Railroad. Under the franchises of the two roads construction has been begun on a four-track third-rail electric road to run from 138th street in The Bronx to Port Chester on the Connecticut state line, a distance of twenty-two miles. The route lies through private right of way, with no grade crossings, and runs through the principal towns of lower Westchester county. A branch thirteen miles long, from Pelham *via* Mount Vernon and Scarsdale to White Plains, is to have three tracks and a similar three-track branch is to run to Clason's Point and Throgg's Neck, a distance of six miles. Of the authorized capital stock of $20,000,000 there has been issued $19,000,000. First mortgage five per cent gold bonds to the extent of $15,000,000 have also been issued. W. L. Bull is president and R. C. Coleman secretary of the company, the directorate of which includes William H. Buckley, F. Bull, W. L. Bull, R. C. Coleman, Evans R. Dick, Andrew Freedman, Charles E. Lewis, John R. McAllister, William Barclay Parsons, Marsden J. Perry, Robert C. Pruyn, Charles Pryor, R. E. Robinson, Oakleigh Thorne and F. W. Whitridge.

TELEPHONE AND TELEGRAPH.

PLATTSMOUTH, NEB.—At a meeting of the stockholders and the board of directors of the Plattsmouth Telephone Company the capital stock was increased to $300,000.

CAMDEN, N. J.—The Eastern Telephone Company is extending its system in Camden. A bond of $5,000 has been given by the company to the city as security that the streets shall be placed in proper condition.

REDLANDS, CAL.—The Sunset Telephone Company has received the wire to build fifty miles of telephone lines through the local mountain, connecting the cabins of the forest rangers. Work will begin at once.

SALISBURY, N. C.—Plans are on foot by the Bell Telephone Company to establish a complete rural telephone system throughout Rowan county, whereby all the principal farm houses in the county will be connected by telephone with this city and other points.

CRESTON, IOWA—The leading independent telephone companies of southern Iowa are discussing the building of a copper line to operate through southern Iowa and to Des Moines and Omaha. Already a large amount of copper is being strung between these points and south from here to Maryville and St. Joseph. The companies' representatives are agreed as to the necessity of hastening this work.

SHELBURNE FALLS, MASS.—At the annual meeting of the Heath Telephone Company the following officers were elected: President, W. E. Kinsman; clerk, Herbert Newell; treasurer, Herbert Newell; directors, W. E. Kinsman, D. G. Taylor, F. L. Totman, A. Newell, W. A. Barber, F. H. Smith and A. J. Patterson. Mr. Smith and Mr. Patterson were elected in place of G. E. Davis and S. B. Crafts, resigned. The company now has about 925 subscribers.

PHILADELPHIA, PA.—With the opening of "Woodland," the new Bell telephone central office, at Fifty-fourth street and Woodland avenue, several thousand persons whose telephones heretofore have been in the Preston district are operating under new numbers. A few years ago all telephones in West Philadelphia were operated through the Preston exchange. The rapid increase in patrons necessitated additional facilities, and in May, 1906, the Belmont exchange was established. The Woodland exchange is still another branch of the old Preston district. The switchboard in the new building has a capacity of 9,600 lines. The building itself is of colonial architecture, constructed of limestone and brick, and cost, fully equipped, $200,000.

SPOKANE, WASH.—It is announced that a contract is to be entered into by the Home Telephone Company with the Interstate Telephone Company for local and long-distance connections. The Interstate lines now reach a large number of points in the Spokane country, an area of 150,000 square miles in eastern Washington, northern Idaho, northeastern Oregon, southeastern British Columbia and western Montana, and as soon as the lines now under construction and projected are completed the company will cover the bulk of the Pacific's field in this inland empire of the northwest. The Home company has long-distance connections between Everett, Wash., and every town and city in Oregon, as far as Portland. The line will be extended from Everett to Spokane, but the company contemplates no incursion into the local field beyond the business in Spokane itself. For connections in the Spokane country it will depend upon its traffic agreement with the Interstate company. The Home company's long-distance lines will permit the Interstate company to reach Puget Sound and Pacific coast points, while the lines of the Interstate company will give the Home company entrance into the Coeur d'Alene mining district and the Palouse and Big Bend wheat belts, which could only be reached at large expense by the Home company if it were compelled to string its own wires into the territory.

ELECTRIC LIGHTING.

CRANDON, WIS.—Otto Eckhoff, of Wittenberg, will apply for a lighting franchise in Crandon.

HAVELOCK, ONT.—The work of developing the Healey falls and rapids has been commenced by the Northumberland-Durham Power Company.

ALBION, N. Y.—A stock company is to be formed to buy the Lakeside property of the present owner and build an electric light and power station thereon.

YOUNGSTOWN, OHIO—At a meeting of the lighting committee of the city council it was decided to report favorably on the proposition for a municipal lighting plant.

LAFAYETTE, IND.—The present contract for lighting the streets and public buildings of Lafayette is about to expire. The board of public works is advertising for bids for lighting the city for a period of ten years.

DETROIT, MICH.—At a meeting of the Trenton council, the proposition of the Edison Illuminating Company, of Detroit, to take over the water and lighting plants of the village and continue them on a ten-year contract was accepted.

DETROIT, MICH.—As a result of the report of H. H. Crowell, of Syracuse, N. Y., who has been investigating the lighting situation in Detroit, the rate for current will be reduced from sixteen to fourteen cents per kilowatt-hour, beginning July next.

LOS ANGELES, CAL.—On the advice of the board of public works the city council purchased, under the emergency provisions of the charter, a hydroelectric plant to be used on Cottonwood creek in the Owens river valley. The price paid was $18,039 and the contract went to the Westinghouse company.

ALTOONA, PA.—The Citizens' Electric Light Company has closed a deal with the Juniata Water and Water Power Company to supply it with current from its new water-power plant at Warriors Ridge for ten years. The Citizens' company will shut down its local plant and maintain it for emergency purposes.

BANGOR, PA.—The citizens and business men of Bangor have organized the People's Electric Light, Heat and Power Company. The temporary officers elected are: President, Emanuel Shoch; secretary, George Wise. A local concern has made a proposition to finance the proposition, providing the company gets a charter.

HAMILTON, ONTARIO—Engineer Sothman, of the hydroelectric power commission, has given the board of works an estimate of the cost of installing a municipal lighting and power plant. For lighting alone his estimate of the total capital cost was $175,580, with an annual cost of operation of $35,517, or $51.03 per lamp per annum.

ARMOUR, S. D.—The city council of Armour has entered into a contract with the Wagner, Lake Shore & Armour Traction Company, which is installing an electric light plant and power-house in this city, to install four 1,200-candle-power arc lights at $6 per month. The city reserves the right to change from arc to incandescents, or *vice versa*, at any time.

CENTRAL CITY, NEB.—The city council has granted a franchise for the construction and operation of an electric light plant to L. S. Jenkins and H. D. Forrest, of Omaha, and work on the plant is under way. The city has contracted for forty lights of 200 candle-power each, and four arcs of 2,000 candle-power each for street lighting purposes. The plant will cost $15,000.

NORWOOD, N. Y.—A new contract, dating from October 1, has been made between the Norwood Electric Light and Power Company and the Norwood village board by which an all-night service has been secured. The charge for street lighting is to be the same as heretofore, $50 per light per year, and for incandescent lighting the price is not to exceed nine cents per kilowatt-hour.

MARINETTE, WIS.—The big water-power development of the Perley Lowe Company, at Peshtigo, has been completed, and arrangements have been made for furnishing light and power to the cities of Peshtigo and Oconto. This development is the first of several that were planned some time ago. The second one, at High Falls, will be finished next spring and power transmitted to Marinette and Menominee.

HARTFORD, CT.—The stockholders of the Hartford Electric Light Company at a special meeting unanimously voted to accept the act recently passed by the legislature authorizing it to increase its capital stock to $5,000,000. The company now has an outstanding capitalization of $2,100,000. At a subsequent meeting of the directors a two per cent quarterly dividend was declared. It is not expected that any additional stock will be issued for several months.

GLENDALE, CAL.—L. C. Brand asks the city of Glendale to pay $21,000 for his entire electric light and power system. The plant is said to be on a paying basis, but, in order to give service wherever required, it would be necessary to make a considerable addition to the lines. It would probably require a bond issue of $40,000 to purchase the plant and make the needed extensions. Many requests for light are now on file, especially from the newer tracts where buildings are constantly going up.

NORTH PLATTE, NEB.—A twenty-year franchise has been granted to the North Platte Electric Light and Power Company. The franchise granted gives the city the right, every five years, to purchase the plant upon appraisal. The franchise also provides that nothing in it shall restrict the right of the city to construct its own electric light plant or to grant companies the street lighting contracts, and that the electric light company shall at once make improvements to the plant to cost not less than $10,000. The electric light company announces that it will at once begin work and will establish a day circuit next spring.

GREEN BAY, WIS.—An agreement has been reached between the Green Bay Gas and Electric Company and the city of Green Bay in the municipal lighting question. The city will give the company a five-year contract, which stipulates that the streets shall be lighted with 2,000 candle-power lamps at the rate of $70 per lamp per annum; the city is to use 200 lamps. A clause of the contract provides that the city or company may apply to the state railway commission to adjust the price. If $70 is too high, the company will rebate the difference between that price and the price named by the commission. If the price is too low the city will pay the additional amount.

OKLAHOMA, OKLA.—To furnish light and power to Putnam addition at once, later to Oklahoma City as a whole, the Citizens' Light and Power Company, composed chiefly of residents of Putnam addition has been formed with a capital stock of $250,000. Of this amount, $40,000 has been subscribed for immediate use. A charter will be secured at once and application made for a franchise to do business in Oklahoma City. It is the plan of the company to begin work on a plant to be utilized in furnishing the power and light for Putnam addition, a site having been donated for the plant by I. M. Putnam. The plant will be erected under the supervision of F. H. Peck, of St. Louis. The officers of the new company are: Dr. George C. Jones, president; W. H. Phillips, vice-president; W. L. Peck, treasurer; W. E. Grigsby, secretary; F. H. Peck, general manager. The board of directors consists of I. M. Putnam, J. W. Holcomb, Dr. J. H. Earp, C. G. Jones, W. E. Grigsby, W. L. Peck and F. H. Peck.

ALBANY, N. Y.—The State Water Supply Commission has notified the up-state Public Service Commission that it withdraws its objection to the application of the Hudson River Electric Power Company, which proposes to develop the water power in the Sacandaga river section as an auxiliary supply to that generated at Spier Falls. The State Water Supply Commission stated that it is now engaged in making an investigation with a view of determining what can be done toward developing the water powers of the state for public use. Surveys are now being made on the Sacandaga river between Northville and Conklingville, looking toward the building of a large storage dam near Conklingville, which would hold all, or nearly all, of the flood waters of that river. The commission states that there are great possibilities that valuable water power can be developed at or near this point. There is still opposition to the application of the Hudson River Electric Power Company coming from the Fonda, Johnstown & Gloversville Railroad Company, whose tracks would be submerged in the neighborhood of the proposed plant, and from other sources.

PERSONAL MENTION.

MR. ALLEN W. BOWEN, superintendent of the Putnam Light and Power Company, Putnam, Ct., has resigned.

MR. CURTIS STOUTT, of Jonesboro, Ark., has been made manager of the Hot Springs (Ark.) office of the Southwestern Telegraph and Telephone Company.

MR. A. W. McMACKIN, for some time manager for the New Brunswick Telephone Company at St. John, N. B., has been appointed acting general superintendent in place of F. A. Hackett, who recently resigned.

MR. J. C. LOWE, who has been manager of the Home telephone exchange at Corvallis, Ore., is now also in charge of the Albany exchange, relieving C. M. McNiell, who has been temporarily in charge since the transfer of W. D. DeVarney. Mr. McNeill will go to Spokane.

MR. EDWARD E. POTTER, superintendent of the Union and the Dartmouth & Westport Street Railway companies, New Bedford, Mass., has left for Seattle, Wash., to take a position as assistant manager of the Seattle Electric Company, one of the Stone & Webster properties.

MR. EDWARD E. SCRIBNER has recently joined the sales force of the Holophane Company, New York city. His work will be among architects, whose interest in the Holophane system of illumination has grown to such proportions as to warrant the company in detailing a special representative to serve them. Mr. Scribner's headquarters will be in New York city.

EDGAR MAITLAND ATKIN, attorney for the New York Edison Company, will read a paper entitled "An Experiment in Self-Insurance Against Industrial Accidents," on November 13, at the New York State Conference of Charities and Correction, at Albany, N. Y. This paper describes an excellent self-insurance plan which the New York Edison Company has tried and which has worked successfully.

MR. GEORGE J. MILLER, for the past four years chemist for the Toledo (Ohio) Storage Battery Company, has severed his connection with that firm, and with James R. Keeler, has organized the Miller Battery Company, located at 134 and 138 Ontario street, Toledo. Mr. Miller organized the Toledo Storage Battery Company four years ago, and is the inventor of the Miller storage battery. Mr. Keeler was formerly treasurer of the Toledo Electric Company.

MR. E. R. KNOWLES, the well-known consulting engineer, of New York city, has recently been retained as consulting engineer for the light, power and heating installation of the United States Leather Company; the light and power installation in the Municipal Ferry Building; the light, power, heating and refrigeration installation in the A. M. Power Building; the light, power and heating installation in the Hergert Building; the light and power installation in the New York Masonic Temple building; the light, power and heating installation in the Wholesale Fish Dealers' Association, all in New York city; and the light and power installation for the Brooklyn Masonic Temple building.

NEW INCORPORATIONS.

NASHVILLE, TENN.—Jefferson City Electric Company, of Jefferson county. $10,000.

BUTTE, MONT.—Montana Electric Company. Increase of capital from $100,000 to $250,000.

COLUMBUS, OHIO—Knoxville Rural Telephone Company. $3,000. Incorporators: W. J. McClelland and others.

GUTHRIE, OKLA.—Daisy Mutual Telephone Company, of Blackburn. $5,000. Incorporators: George W. Kinner, J. C. Ousley, Thomas Morris and Lewis Loper.

RICHMOND, VA.—The Planters' Telephone Company, Norfolk. $5,000. Officers: J. G. DeBaun, president; J. E. Hall, vice-president; V. Engel, secretary; C. Williamson, treasurer, all of Norfolk.

AUGUSTA, ME.—Strong Lighting and Improvement Company, Strong, Me. To light by electricity or otherwise. $10,000. President and clerk, P. D. Stubbs; treasurer, F. H. Daggett, both of Strong, Me.

RICHMOND, VA.—Vernon Telephone Company, Mount Vernon. $5,000. Incorporators: S. W. Worrell, president, Woodlawn, Va.; A. W. Alderman, vice-president; G. H. Alderman, secretary, Ethelfelts, Va.

ST. LOUIS, MO.—Carondelet & Webster Railway Company, of St. Louis. To construct and operate a railway line from St. Louis to Webster Groves, eight miles. $200,000. Directors: W. E. Winner, J. G. Hages, E. B. Winner, A. G. Bodwell and H. G. Post.

ELECTRICAL SECURITIES.

The stock market last week showed little of the demoralization of a week previous, and while still feverish and apt to tumble over on slight cause, a steady impulse of improvement was manifest, and the week closed with the outlook considerably improved. This does not say, however, that the stock market has reached anything like a normal state. Prices are still low, and despite the heavy outside buying of shares outright, a most hopeful indication, the restoration of confidence is slow. Much has been made of the currency stringency, and until credits have been reestablished it is quite possible that there will be a curtailing of expenditures for improvements and expansion.

ELECTRICAL SECURITIES FOR THE WEEK ENDING NOVEMBER 2.

New York:	*Closing.*
Allis-Chalmers common	5⅛
Allis-Chalmers preferred	15
Brooklyn Rapid Transit	30⅛
Consolidated Gas	82
General Electric	107
Interborough-Metropolitan common	5½
Interborough-Metropolitan preferred	15½
Kings County Electric	95
Mackay Companies (Postal Telegraph and Cables) common	48⅞
Mackay Companies (Postal Telegraph and Cables) preferred	55
Manhattan Elevated	105
Metropolitan Street Railway	24
New York & New Jersey Telephone	91
Western Union	61
Westinghouse Manufacturing Company	52

Directors of the Consolidated Gas Company have declared a regular quarterly dividend of 1 per cent, payable December 16. Books close November 26 and reopen December 17.

The Brooklyn Rapid Transit statement for three months ended September 30, shows net earnings of $934,394, after deducting all charges. This is an increase of $412,627 over the quarter ended September 30, 1906, and is equal to 2.07 per cent earned on the $45,000,000 stock.

Boston:	*Closing.*
American Telephone and Telegraph	92
Edison Electric Illuminating	—
Massachusetts Electric	39
New England Telephone	97
Western Telephone and Telegraph preferred	—

Philadelphia:	*Closing.*
Electric Company of America	7⅞
Electric Storage Battery common	30
Electric Storage Battery preferred	30
Philadelphia Electric	6¾
Philadelphia Rapid Transit	16
United Gas Improvement	68¾

Chicago:	*Closing.*
Chicago Telephone	98
Commonwealth-Edison	—
Metropolitan Elevated preferred	45
National Carbon common	50
National Carbon preferred	100

The South Side Elevated October daily averages of passengers carried was 126,670, an increase of 33,093.

The daily average number of passengers carried by the Metropolitan Elevated in October was 157,080; increase, 14,409.

The National Carbon Company has declared the usual quarterly dividend of 1¾ per cent on its preferred stock, payable on November 15. Books closed on November 5 and will reopen on November 16.

OBITUARY NOTE.

MR. EDWIN J. WILCOXEN, general superintendent of the Rochester (N. Y.) Railway Company, died in Rochester on November 4, following an operation for appendicitis. He was well known in electric railway circles in that city and represented the Vanderbilt interests there.

ELECTRIC RAILWAYS.

HARTFORD, CT.—The railroad commissioners have approved the proposed method of construction of the Shore Line Electric Railway Company from Ivoryton to and through Guilford.

VICTORIA, BRITISH COLUMBIA—Extensions and improvements to the plant and rolling stock of the British Columbia Electric Railway Company in this city to the extent of $150,000 are planned.

IRWIN, PA.—The Pittsburg & Westmoreland trolley line between Irwin and McKeesport, has been thrown open for traffic. It is eleven miles long and will carry a large amount of freight, besides passengers.

SHEBOYGAN, WIS.—The work of laying tracks on the electric line between Plymouth and Elkhart has been started. The ties are all distributed and the promoters expect to have the line in operation by next spring.

MILWAUKEE, WIS.—The formal acceptance of the provisions of the franchise ordinance recently passed by the common council in favor of the Chicago & Milwaukee Electric Railway Company has been filed with the city clerk.

SPRINGFIELD, OHIO—The Ohio Electric Railway Company has purchased thirty-three acres of land near the Lewiston reservoir, upon which it will erect a large power-house. The new plant will be used to supply current for the new Bellefontaine-Lima line.

BOSTON, MASS.—The Massachusetts Railroad Commission has authorized the Boston & Worcester Street Railway Company to issue 300 shares, par value $300,000, of new stock, to pay the floating debt incurred for construction and equipment and the purchase of property. The new shares will be offered to stockholders at $100 per share.

MIDDLETOWN, CT.—The Consolidated Railway Company has awarded the contract for the construction of a trolley line from this city to Middlefield. President Mellen has given definite assurances that the construction of an electric road between Middletown and Hartford will be undertaken early next spring.

MAUCH CHUNK, PA.—The Eastern Pennsylvania Railways Company has ordered $200,000 worth of electric railway material for the Tamaqua & Middleport connecting link between Mauch Chunk and Pottsville. The order includes all the material required for the permanent way and overhead electrical work of a standard interurban railway.

POTTSVILLE, PA.—As a result of the law permitting trolley cars to carry freight, at a meeting of stockholders of the new Hegins Millersburg trolley road, it was decided to build a line piercing the richest agricultural district in this section. It will be the longest trolley line touching the anthracite region, and is a certainty, sufficient capital stock having been subscribed.

SAN DIEGO, CAL.—The San Diego Electric Railway Company, which operates most of the trolley lines here, is considering the proposition of increasing the amount of its capital stock from $500,000 to $5,000,000, the present amount being inadequate for the improvement and extension work which has been done in the past few months and which will be continued in the future.

BLOOMINGTON, ILL.—Following a conference with the officials of the Illinois Traction system a meeting was held at Newport, Vermilion county, Ind., to organize a company to build from Danville, Ill., to Terre Haute, through Perrysville, Cayuga, Newport, Hillsdale and Clinton, keeping to the west side of the Wabash river. Prominent men of these towns are in the movement and committees for each township were appointed to get right of way.

ASHEVILLE, N. C.—The proposed new electric line between Asheville and Hendersonville, which has been in contemplation for some time, has now assumed definite shape. The preliminary survey has been made, the right of way secured, and it is expected that the work of construction will begin at an early date. C. F. White is treasurer of the proposed road, and J. D. Murphy, president. The country which the new road will traverse is a rich agricultural section.

LEWISTON, IDA.—The Spokane & Inland Electric Railway Company will begin an extension of its road to Lewiston and Clarkson next spring. The route followed will be down the Steptoe cañon, reaching the Snake river, nine miles below Lewiston. From that point the road will parallel the Oregon Railway & Navigation Company's line up the river to the mouth of Dry Gulch, where it will cross the river at Clarkson, thence by means of a high bridge, again cross the river to Lewiston.

LA CROSSE, WIS.—An interurban electric line between La Crosse and Winona is thought to be assured by the application of the La Crosse & Winona Electric Railway Company for a franchise through the city of Onalaska. The company is planning to ask for franchises in the smaller cities and will seek entrance into Winona. By the terms of the franchise here under which the La Crosse & Southeastern is operating, a new line does not need a franchise, as it is provided that any new company shall use the tracks of the Southeastern.

ELYRIA, OHIO—The city council has granted a twenty-five-year franchise to the Cleveland, Southwestern & Columbus Railway to build a belt line in this city. The old franchise held by the company also was extended twenty-five years. The traction company will build a belt line, selling six tickets for twenty-five cents, thirteen tickets for fifty cents and twenty-six tickets for $1. After ten years seven tickets will be sold for twenty-five cents. The ordinance was accepted by the traction company and it immediately filed a bond of $10,000 as a guarantee that it will carry out its contract.

MURPHYSBORO, ILL.—The Murphysboro & Interurban Railway Company has been organized and a charter has been applied for. The company is composed of Murphysboro business men and manufacturers, who propose to build an electric railway in and around Murphysboro and to Carbondale. At a meeting $50,000 was subscribed and the following commissioners appointed to attend to organizing and incorporating the company: A. B. Minton, owner of the mule-car line, now in operation here; Willard Wall, banker; W. C. Alexander, of the Murphysboro Ice and Cold Storage Company; John G. Hardy, banker; P. H. Eisenmayer, president of the Southern Illinois Milling and Elevator Company.

MACON, GA.—A reorganization of the Macon Railway and Light Company has taken place. W. Jordan Massee now is at its head with a new general manager and a new secretary and treasurer. J. T. Nyhan, the former general manager, and J. H. Hertz, the secretary and treasurer were not reelected, but in their places J. W. McFarland, of Chattanooga, and J. E. Jaudon, were named. A new board of directors was named as follows: Jacob S. Collins, T. J. Carling, Leon S. Dure, W. J. Massee, Morris Happ, F. B. Stubbs, M. Felton Hatcher, Joseph M. Neel, J. C. Walker, A. T. Small, M. H. Massee and Jacob Paulson. Jacob S. Collins was elected vice-president of the company, and M. Felton Hatcher second vice-president. The only money that is said to have changed hands in cash is $50,000, the remainder being in notes. After the meeting of the directors a lengthy statement was given out by President W. Jordan Massee in which many promises of cheaper lights, better service and better lights were made.

OROVILLE, CAL.—A copy of the articles of incorporation of the Northern Electric Railway Company has been filed with the county clerk. It recites the purpose of the new corporation to be to take over the Northern Electric Railway and to acquire the franchise and what rights the Shasta Southern possesses. The following new lines are mapped out for construction: Chico-Red Bluff-Redding line—estimated length, seventy-six miles; Sacramento-Folsom line—twenty miles; Sacramento-Woodland-Colusa-Hamilton line—108 miles; Colusa-Yuba City line—twenty-six miles. The capital stock is fixed at $25,000,000, divided into 250,000 shares of a par value of $100. This stock is divided into the preferred stock, consisting of 100,000 shares, and the common stock, consisting of 150,000 shares. The articles of incorporation provide that the "dividends to the extent but not in excess of five per centum per annum shall first be declared set apart and become payable from such surplus profits upon the issued shares of said preferred stock." Dividends to the extent of five per cent shall then be paid upon the common stock. Further dividends are payable upon preferred and common stock without discrimination. The board of directors is made up of R. Augustus Bray, who is credited with 3,360 shares; Alan W. Maginis, Curtis Hilyer, Francis C. van Deinse, Martin L. Washburn, Harry C. Mack and Charles Elsey, of whom the articles state that they have subscribed for five shares.

INDUSTRIAL ITEMS.

THE UNION SWITCH AND SIGNAL COMPANY, Swissvale, Pa., has ready for distribution its November calendar, which gives in color reproductions the language of fixed signals.

THE ANSONIA BRASS AND COPPER COMPANY, Ansonia, Ct., has published a new catalogue devoted to "Tobin" bronze. Copies of this catalogue will be sent to any one interested upon request.

THE BALL ENGINE COMPANY, Erie, Pa., has opened a sales office at 1001 Arcade Building, Philadelphia, Pa., under the management of H. P. Penfield, for the sale of its automatic and Corliss engines.

THE DIELECTRIC COMPANY OF AMERICA, Belleville, N. J., has published a valuable booklet devoted to a description of its underground system. This booklet will be sent to any one interested upon request.

THE GRAY TELEPHONE PAY STATION COMPANY, Hartford, Ct., has issued a new booklet describing the Gray Telephone pay station and measured service equipment. This will be sent to any one interested upon request.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has issued bulletins No. 106 and No. 107, describing and illustrating, respectively, the chloride accumulator for alternating-current regulation, and the chloride accumulator as applied to the single-phase system of the Spokane & Inland Railway.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, 17 Park Place, New York city, has announced an extensive line of electrical goods for the holidays. Full information and price lists are now available upon electrical toys, small power apparatus, Christmas tree outfits, etc., upon application to the company.

THE NERNST LAMP COMPANY, Pittsburg, Pa., has published a handsome booklet entitled "Bank and Office Lighting by Electricity." This book is illustrated by a number of carefully-worked-out half-tone engravings, showing the utilization of Nernst lamps for the effective illumination of places where important visual work is required.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., has ready for distribution a supplementary bulletin containing additions and changes affecting its catalogues B-17 and B-17A. A number of new devices, which it is believed will meet with the approval of the trade, are listed. This bulletin will be sent to any one interested upon request.

THE GREEN FUEL ECONOMIZER COMPANY, Matteawan, N. Y., has issued a sixteen-page booklet entitled "The Economical Heating of Water and Air in Breweries and Malt Houses." The first seven pages of the booklet are devoted to a reprint of an article by C. Eberle, of Munich, on "The Influence of Boiling by Steam on the Boiler Plants of Breweries."

THE ELECTRIC CONTROLLER AND SUPPLY COMPANY, Cleveland, Ohio, has published a booklet devoted to its magnetic switch controllers for handling electric motors. This booklet is replete with interesting data and instructive illustrations, indicating the excellent service performed by these controllers. The company will be pleased to forward copies upon request.

THE TREGONING ELECTRIC MANUFACTURING COMPANY, Cleveland, Ohio, has ready for distribution a new catalogue and price list devoted to its electrical specialties. This includes descriptions and prices on separable attachment plugs, fusible rosettes, fuseless rosettes, the "Lobster-Claw" battery connector, the Tregoning sign receptacle, and the fuseless rosette with socket attachment.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., has opened an office at Deadwood, S. D., with O. F. Purnell as district manager. Special attention will be given by Mr. Purnell and the members of his staff to the sale of mining, crushing, pumping, power and electrical machinery, many installations of which have been made by Allis-Chalmers Company and its predecessors throughout that section of country.

THE CENTRAL ELECTRIC COMPANY, 264-270 Fifth avenue, Chicago, Ill., has ready for distribution a very interesting pamphlet devoted to holiday suggestions. This pamphlet illustrates a number of electric reading lamps and portables which the company has recently developed. The company has established a fixture department, where an elaborate display of electric lamps is shown. This pamphlet will be sent to any one interested upon request.

THE GOULD STORAGE BATTERY COMPANY, 341-347 Fifth avenue, New York city, has published a valuable book describing the Gould storage battery. This gives full details concerning the building-up of the Gould plate and its application in service. Two bulletins, No. 8 and No. 9, describing and illustrating, respectively, an interurban railway distribution system, and storage batteries on alternating-current systems, are ready for distribution and will be furnished to any one interested upon request.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., is distributing a folder dedicated to the good fellows who helped the Joseph Dixon Crucible Company to spend its money at Atlantic City in connection with the recent exhibit of the American Street and Interurban Railway Manufacturers' Association. The folder has been presented through the courtesy of that amiable genius, C. H. Spotts, manager of the paint department of the Joseph Dixon Crucible Company. The pages are adorned with several interesting reproductions of Mr. Spotts in various characteristic attitudes. The first illustration is the only one, however, which the friends of Mr. Spotts will believe him capable of assuming.

THE CUTLER-HAMMER CLUTCH COMPANY, Milwaukee, Wis., has issued a thirty-two-page booklet devoted to its lifting magnets. The booklet contains a number of full-page illustrations showing lifting magnets handling pig-iron, steel stampings, castings, scrap and other material, together with diagrams, data on current consumption, and information on lifting capacity of magnets. A new cable take-up device is also illustrated and described, and reference is made to the Cutler-Hammer system of control, by which a strong inductive reaction or kick which occurs when a circuit is suddenly opened on a magnet coil is automatically shunted to a discharge resistance, thus protecting the magnet insulation by dissipating the energy of the induced voltage outside of the coil itself.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Cosmos Club, Washington, D. C. Annual meeting, Chicago, Ill., December.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis avenue, New York city.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Meetings fourth Friday of each month.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Professor Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Fifty-seventh street, New York city.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth street, New York city. Annual meeting, New York city, December 3-6.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Municipal Building, Brooklyn, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, Elmer M. White, treasurer Birmingham Railway, Light and Power Company, Birmingham, Ala.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. W. Freeman, vice-president and general manager Edison Electric Illuminating Company, Brooklyn, N. Y.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, P. C. Brown, Boston, Mass.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, W. F. Milholland, Secretary and treasurer Indianapolis Traction and Terminal Company, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. F. Dostal, Denver, Col.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Ct.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, John P. Faure, 77 Water street, Ossining, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau street, New York city.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt street, New York city.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. B. Cheadle, Joliet, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Van Rensselaer Lansingh, Engineering Societies Building, 33 West Thirty-ninth street, New York city.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Texas.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. S. Norton, Indianapolis.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles West, Allentown, Pa.; assistant secretary, J. A. Harney, Electric Building, Cleveland, Ohio. Annual meeting, Chicago, Ill., January 21-23, 1908.

IOWA STATE ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. S. Vivian, Grand Rapids, Mich.

MISSOURI STATE ELECTRIC LIGHT ASSOCIATION. Secretary, C. C. Pierson, St. Charles, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George Schweer, Windsor, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee Street, Utica, N. Y.

NATIONAL ELECTRIC TRADES ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, W. W. Freeman, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb. Next meeting, Omaha, Neb., January, 1908.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl street, Boston, Mass. Meetings held on fourth Thursday of every month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary R. N. Kimball, Kenosha, Wis. Next annual meeting, Milwaukee, Wis., January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city. Annual meeting postponed until next year.

ORDER OF THE REJUVENATED SONS OF JOVE. C. B. Roulet, Mercury, Dallas, Texas.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKES PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa.

RAILWAY TELEGRAPH SUPERINTENDENTS' ASSOCIATION. Secretary, P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis. Next annual meeting, Montreal, Canada, June 24-26, 1908.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D. Next meeting, Mitchell, S. D., January 8-9, 1908.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, R. B. Stichter, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York, N. Y.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, Chicago.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

American Association for the Advancement of Science. Chicago, Ill., December.

American Society of Mechanical Engineers. Annual meeting, New York city, December 3-6.

South Dakota Independent Telephone Association. Mitchell, S. D., January 8-9, 1908.

Chicago Electrical Show. Coliseum, Chicago, January 13-25, 1908.

International Independent Telephone Association. Annual meeting, Chicago, Ill., January 21, 22 and 23, 1908.

Nebraska Independent Telephone Association. Next meeting, Omaha, Neb., January, 1908.

Record of Electrical Patents.

Week of October 29.

869,229. MOTOR CONTROL. Eugene R. Carichoff, East Orange, N. J., assignor to Otis Elevator Company, East Orange, N. J. Two starting resistances are used, controlled by an automatic switch.

869,243. ELECTRICAL SYSTEM OF DISTRIBUTION. Albert S. Hubbard, Greenwich, Ct., and William A. Turbayne, Lancaster, N. Y., assignors to Gould Storage Battery Company. An alternating-current transmitting, direct-current distributing, system.

869,244. ALTERNATING-CURRENT APPARATUS. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. A regulating apparatus, controlled by a battery, and governing the system according to the character of the load.

869,248. ENGINE STOP-VALVE. James L. Kimball, Salem, Mass. A stop-valve controlled by an electromagnet.

869,275. BLOCK-SIGNALING SYSTEM. Louis H. Thullen, Swissvale, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. The car carries a coil in inductive relation to the signaling circuit.

869,276. PROCESS OF REDUCING COMPOUNDS WITH ELECTRICALLY DEVELOPED HEAT. Frank J. Tone, Niagara Falls, N. Y. Silica, and a compound containing silicon, oxygen and carbon are heated in an electric furnace.

869,279. ELECTRICAL SYSTEM OF DISTRIBUTION. Edward Van Wagenen, New York, N. Y., assignor to Gould Storage Battery Company. A combined alternating and direct-current system, the fluctuations in one being controlled by the other.

869,286. ELECTRICAL SYSTEM OF DISTRIBUTION. Walter E. Winship, New York, N. Y., assignor to Gould Storage Battery Company. A storage battery and regulator for controlling an alternating-current system.

869,300. ARC-LAMP ELECTRODE. Richard Fleming, Lynn, Mass., assignor to General Electric Company. An iron tube filled with iron particles.

869,301. ARC-LAMP ELECTRODE. Richard Fleming, Lynn, Mass., assignor to General Electric Company. An iron tube filled mainly with iron oxides.

869,306. ELECTRICAL SYSTEM OF DISTRIBUTION. Albert S. Hubbard, Belleville, N. J., and William A. Turbayne, Lancaster, N. Y., assignors to Gould Storage Battery Company. A regulating alternating-current circuit for controlling the battery of a direct-current distributing system.

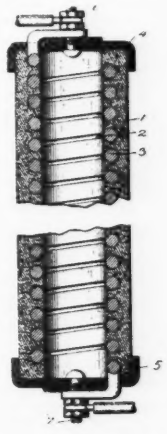
869,314. RESISTANCE UNIT. Campbell Macmillan, Schenectady, N. Y., assignor to General Electric Company. The resistance wire is surrounded by material having a negative temperature resistance coefficient.

869,321. INSULATING MATERIAL AND METHOD OF MANUFACTURING SAME. Robert Müller, Munich, Germany. A composition of fragmentary mineral fireproof material united by a pitchy substance.

869,348. STORAGE-BATTERY GRID. Rufus N. Chamberlain, Depew, N. Y., assignor to Gould Storage Battery Company, New York, N. Y. A grid with tapering ribs for forming.

869,352. MOTOR-CONTROL SYSTEM. Maxwell W. Day, Schenectady, N. Y., assignor to General Electric Company. Two motors are employed for giving different speeds.

869,356. MOTOR CONTROLLER. Wilhelm Fielder, Berlin, Germany, assignor to General Electric Company. A centrifugally actuated cutout for interrupting a reverse current.



869,314.—RESISTANCE UNIT.

869,359. RELAY FOR CIRCUIT-BREAKERS. Max Fuss, Berlin, Germany, assignor to General Electric Company. A reversible motor operated either by an excess or a reversed current.

869,365. BLOCK-SIGNAL SYSTEM. Laurence A. Hawkins, Schenectady, N. Y., assignor to General Electric Company. An alternating-current system.

869,368. ADJUSTABLE SUPPORT FOR TELEPHONE RECEIVERS. Ross Higgins, Canfield, Ohio. A holder attached to the transmitter arm.

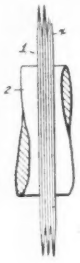
869,403. STRAIN INSULATOR. Albert Anderson, Boston, Mass., assignor to Albert and J. M. Anderson Manufacturing Company, Boston, Mass. A three-piece insulator consisting of two bars and a coupling piece.

869,404. STRAIN INSULATOR. Albert Anderson, Boston, Mass., assignor to Albert and J. M. Anderson Manufacturing Company, Boston, Mass. A two-piece linked insulator.

869,413. FREQUENCY CHANGER. Walter S. Bralley, Schenectady, N. Y., assignor to General Electric Company. Two synchronous induction machines coupled together.

869,420. PRINTING TELEGRAPH. Berry W. Cochran, Los Angeles, Cal. A synchronous system.

869,432. ELECTRIC FURNACE. Gustave Gin, Paris, France. A tilting furnace with three reaction chambers.



869,348.—Storage-Battery Grid.

869,442. APPARATUS FOR MEASURING SPEED OF ROTATION. Walter D. Litchfield, Schenectady, N. Y., assignor to General Electric Company. An automatic timing device.

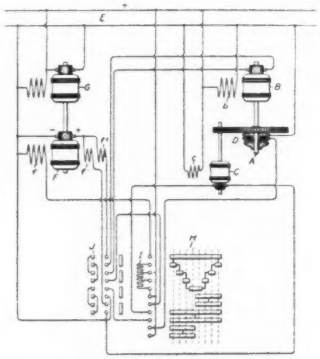
869,446. PROCESS FOR MAKING DRY CELLS. Paul L. Meyer, New York, N. Y., assignor to John F. Hemenway, New York, N. Y. A porous cup of plaster of Paris is used.

869,449. MEASURED-SERVICE SYSTEM FOR TELEPHONE LINES. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company, Chicago, Ill. A meter for party-line circuits.

869,450. MEASURED SERVICE SYSTEM FOR TELEPHONE LINES. James L. McQuarrie, Oak Park, Ill., assignor to Western Electric Company, Chicago, Ill. A connection register at the central office for party-line systems.

869,459. ELECTRIC RAILWAY SYSTEM. William B. Potter, Schenectady, N. Y., assignor to General Electric Company. A safety sectional conductor system.

869,460. ELECTRIC HEATING FABRIC. Walter Richmond, Memphis, Tenn. A controlling thermostat is placed within the fabric.



869,352.—Motor-Control System.

869,464. ELECTRIC HEATER. George E. Stevens, Lynn, Mass., assignor to General Electric Company. A faucet attachment.

869,465. THIRD-RAIL CONTACT-SHOE. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to General Electric Company. A yielding support for contact shoes.

869,467. RAILWAY SIGNAL. Charles W. S. Turner, Mountville, Va. A block-signaling system.

869,468. ELECTRIC SIGN. William Wallace, Philadelphia, Pa. A sign carrying incandescent lamps.

869,490. RELAY. Lemuel F. Howard, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. A relay for a signaling system, controlled by currents of different frequencies.

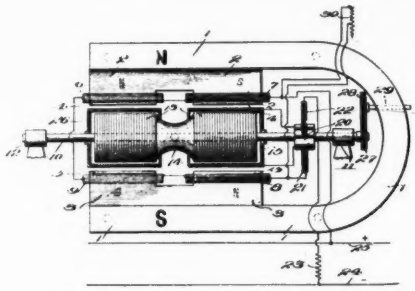
869,531. RAILWAY SIGNALING. Jacob B. Struble, New York, N. Y., assignor to the Union Switch and Signal Company, Swissvale, Pa. A rectifier for operating a direct-current signaling system from alternating-current railway supply system.

869,554. AUTOMATIC TESTING AND RESETTING MEANS FOR ELECTROTHERMAL PROTECTORS. Frank B. Cook, Chicago, Ill. Provision is made for testing the thermostat.

869,555. BLOCK-SIGNAL SYSTEM. William Daves, Bloomington, Ill. An electrically lock manual system.

869,576. SIGNALING SYSTEM. Edward E. Kleinschmidt, New York, N. Y., assignor to George M. Seeley, New York, N. Y. A track-battery circuit which is closed by the passage of a car.

869,595. TRANSFORMATION OF ELECTRIC CURRENTS. William T. Taylor, Chihuahua, Mexico. A composite polyphase system.



869,602.—Electrical Apparatus.

869,602. ELECTRICAL APPARATUS. Thomas W. Varley, New York, N. Y. A magnet of constant strength which is independent of variations in the applied voltage.

869,634. WIRELESS TELEGRAPHY. William S. Hogg, U. S. Navy. The spark-gap terminals are spherical and concentric.

869,684. ELECTRIC REGULATOR. Albert H. Barber, Watertown, N. Y., assignor of one-half to Jay M. Mullen, Watertown, N. Y. An inductive coil with adjustable core.

869,711. TROLLEY. Samuel D. Hunt, Youngstown, Ohio. A trolley head for multiple contact wires.

869,714. WIRELESS SIGNALING SYSTEM. Joseph L. Jones, Kizer, Tenn. A system for use on locomotives.

869,728. ALARM MECHANISM. Leroy Paisley, Waverly, Ohio. A signal system for mail boxes.

869,737. MULTIPLE SOCKET FOR INCANDESCENT LAMPS. Frank J. Russell, New York, N. Y. The holding contacts are carried on the body of the socket and the central contacts on the lid.

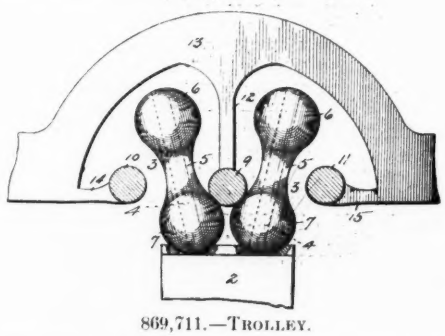
869,760. ELECTRICALLY CONTROLLED ELEVATOR. Carl T. Westlin, Arlington, N. J. The controlling circuit is broken by the opening of a door.

869,780. ELECTRIC MOTOR. John P. Hayes, Pittsburg, Pa. A reciprocating motor.

869,785. ELECTRICALLY OPERATED SIGNAL FOR RAILROADS. Helena J. Jones, Baltimore, Md. A block-signaling system.

869,788. INSULATED JOINT. Frank E. Kinsman, Plainfield, N. J. An insulated wheel for traction purposes.

869,812. CONTROLLER. Emmett W. Stull, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. A series-parallel controller.



869,711.—Trolley.

869,824. CONTROL SYSTEM. Louis M. Aspinwall, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. The reversing switch can not be returned to the off position until the circuit-breaker is open.

869,843. TROLLEY HEAD FOR ELECTRIC TRACTION. Garnet B. Holmes and Arthur D. Allen, Wellington, New Zealand. The wheel is flexibly mounted in slots.

869,852. CLIP FOR ELECTRICAL APPARATUS. Hubert Krantz, Brooklyn, N. Y. An L-shaped terminal

869,858. CREDIT-MARKING APPARATUS. John J. Leidigh, Milwaukee, Wis. An electrical device used with punched cards.

869,864. AUTOMATIC RESETTING AND TESTING MEANS FOR THERMAL PROTECTORS. Frank B. Cook, Chicago, Ill. A device reset by a spring.